



SMALL ARMS
FIRING REGULATIONS

BLUNT

U.S. Army Military History Institute^a

(*BY AUTHORITY*)

FIRING REGULATIONS

FOR

SMALL ARMS

FOR THE

UNITED STATES ARMY

PREPARED BY COMMAND OF BRIGADIER-GENERAL S. V. BENÉT
CHIEF OF ORDNANCE, U. S. ARMY

BY

CAPTAIN STANHOPE E. BLUNT

*Ordnance Department, Inspector of Small Arms Practice at the
Headquarters of the Army*

THIRD EDITION

NEW YORK

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HEADQUARTERS ARMY OF THE UNITED STATES,
WASHINGTON, D. C., December 4, 1884.

CHIEF OF ORDNANCE, U. S. ARMY,
WASHINGTON, D. C.

SIR: I have the honor to submit herewith the "Instructions in Rifle and Carbine Firing," prepared in obedience to your orders as approved by the Secretary of War.

In accordance with your directions, that the experience of the Army in rifle firing be embodied in this work, I early addressed copies of a circular-letter of inquiry to the Headquarters of the Military Divisions and Departments, requesting that they be forwarded to those officers whose experience would make their opinions most valuable; I was thus placed in possession of the advice and recommendations of more than one hundred officers, nearly all company commanders, who during the last three or four years had devoted the greatest amount of both time and attention to this important subject, their opinions have been of great assistance to me (and I here desire to acknowledge my obligations to them and to the many officers I have personally consulted), and as upon all important points, they practically agreed, they have to a great extent furnished the suggestions and conclusions which in the following pages I have merely formulated.

I have also been permitted access to all the reports with reference to target firing and to the annual competitions, which are on file in the War Department.

Colonel T. T. S. Laidley, Ordnance Department, kindly acceding to my request, permits me to embody portions of his valuable work on Rifle Firing, under which the Army in the past few years has made such remarkable improvement in target practice.

General Geo. W. Wingate, formerly the General Inspector of Rifle

90-69

Information for Riflemen on the Range and Battle-field, Kelton.

- Quinan's Score-Book for Riflemen.**
Henry's Information for the Rifle Range.
Lieutenant F. A. Boutelle, 1st Cavalry, on "Gallery Practice, in the Transactions of the Convention of the Officers of the Wisconsin National Guard.
The Rifle Club and Range, Weston. New York, 1879.
Rules for the Management of the Springfield Rifle, 1882.
Walker's, The Rifle.
Willcox's Rifles and Rifle Practice.
Cleveland's Hints to Riflemen.
The Rifle and How to Use it, by Hans Busk.
The Modern Sportsman's Gun and Rifle, by J. H. Walsh. London, 1884.
Sporting Fire Arms, by Captain F. F. R. Burgess, Bengal Staff Corps London, 1884.
Annual Reports of the Inspectors of Rifle Practice, Departments of the East, Platte, Missouri, and Dakota.
Synopsis of Orders and Decisions relating to Target Practice. Lieutenant W. C. Manning, 23d Infantry.
Orders from Headquarters of the Army.
Orders from the Headquarters of the Different Divisions and Departments.
Annual Reports of the General Inspector of Rifle Practice, State of New York.
Annual Reports of the National Rifle Association.
Ordnance Manual.
Ordnance Notes.
U. S. Army Infantry Tactics.
U. S. Army Cavalry Tactics.
Journal of the Military Service Institution of the United States.
Journal of the Royal United Service Institution.
Revue d'Artillerie.
Revue Militaire de l'Etranger.
Text-Book for Officers at Schools of Musketry, Revised Edition. London, 1877.
Hand-Book for Hythe.
Rifle Exercises and Musketry Instruction, London, 1882.
Regulations for Musketry Instruction. London, 1884.
Règlement sur l'Instruction du Tir. Fourth Edition. Paris, 1884.
Schless-Instruktion für die Infanterie. Berlin, 1882.
Cartilla de Tiro para la Infanteria. Madrid, 1881.
Istruzioni sulle armi portatili. Rome, 1878.

Very respectfully, your obedient servant,

(Sgd.) S. E. BLUNT,

Captain of Ordnance, Inspector of Rifle Practice at the Headquarters of the Army

ORDNANCE OFFICE, WAR DEPARTMENT,
WASHINGTON, D. C., December 6, 1884.

THE HONORABLE

THE SECRETARY OF WAR.

SIR: I have the honor to submit for your consideration, "Instructions in Rifle and Carbine Firing for the U. S. Army," prepared by Captain S. E. Blunt, Ordnance Department, under the following instructions:

ORDNANCE OFFICE,
WASHINGTON, D. C., October 30, 1883.

THE HONORABLE

THE SECRETARY OF WAR.

SIR: On April 7, 1879, "A Course of Instruction in Rifle Firing," prepared by Colonel Laidley, was approved by the Secretary of War. The preparation of this work was indeed ordered by the Secretary of War, November 28, 1877. That course of instruction filled a want that had been felt for years, and has been of great benefit to the service. At the present time we have an army of marksmen, and this gratifying result is due largely to Laidley's "Rifle Firing."

This work is not without its faults, however, and the very many calls for explanation, and the many suggestions made, show very conclusively that the time has come when a revision of this course of instruction, or a new work, is necessary, to embody all the valuable experiences of the army in target practice.

I have the honor to recommend that Captain S. E. Blunt, Ordnance Department, Inspector of Rifle Practice, Department of Dakota, may perform this duty. I am satisfied that his experience is second to none, and that the excellent results accomplished in that department, point to him as thoroughly competent for this work.

Very respectfully, your obedient servant,

(Sgd.) S. V. BENÉT,

Brigadier-General, Chief of Ordnance.

FIRST ENDORSEMENT.

Approved.

By order of the Secretary of War,

(Sgd.) JOHN TWEEDALE,

Chief Clerk.

WAR DEPARTMENT,
October 30, 1883.

ORDNANCE OFFICE,
WASHINGTON, D. C., October 30, 1883.

BRIGADIER GENERAL A. H. TERRY,
COMMANDING DEPARTMENT OF DAKOTA,
FORT SNELLING, MINN.

GENERAL: I have the honor to enclose copy of a letter addressed by me to the Honorable Secretary of War, in which I recommend that *Captain S. E. Blunt*, Ordnance Department, and Inspector of Rifle Practice in your Department, may perform the duty of revising Laidley's "Rifle Firing," or of preparing a new work, that will embody all the valuable experiences of the army in target practice. This recommendation has received the approval of the Secretary of War.

Now that the season for target practice is about over, I have no doubt that Captain Blunt will find sufficient time during the winter to prepare a work that will redound to his credit, and be of the greatest benefit to the military service.

I have no suggestions to make, but will gladly give him such assistance as he may need in the prosecution of his important labors.

The interest manifested in the Department of Dakota and the signal results accomplished, in target firing, is the best proof that the department commander has given the matter his countenance and support, and I rest satisfied that Captain Blunt will receive at his hands every assistance and encouragement.

Respectfully, your obedient servant,

(Sgd.) S. V. BENÉT,

Brigadier-General, Chief of Ordnance.

In his letter of transmittal herewith, Captain Blunt gives due credit to Colonel Laidley, General Wingate, and others, to whose publications and assistance he is largely indebted. The great value of his work depends, however, on the fact that it embodies the experience of the army during the past five years of target practice, under the peculiar and varied conditions of climate and service. His practical knowledge of the details of the subject, being himself an expert marksman, wearing honorable rewards of his skill in rifle contests, render his views of special value and

importance, and warrant the belief that these "Instructions" will so satisfy the army as to add greatly to his well-established reputation.

I have the honor to recommend the reference of this work to the Lieutenant-General commanding the Army.

Very respectfully, your obedient servant,

(Sgd.) S. V. BENÉT,

Brigadier-General, Chief of Ordnance.

FIRST ENDORSEMENT.

Respectfully referred to the Lieutenant-General commanding the Army.

(Sgd.) ROBERT T. LINCOLN,

Secretary of War.

WAR DEPARTMENT,

December 6, 1884.

Report of a board of officers convened at Chicago, Ill., by the following order :

HEADQUARTERS OF THE ARMY,

ADJUTANT GENERAL'S OFFICE,

WASHINGTON, December 11, 1884.

SPECIAL ORDERS, }
No. 290, }

I. A Board of Officers, to consist of Captain Stanhope E. Blunt, Ordnance Department ; 1st Lieutenant William C. Manning, 23d Infantry ; 1st Lieutenant George D. Wallace, 7th Cavalry, will convene at Chicago, Ill., on the fifth day of January, 1885, or as soon thereafter as practicable, to examine and revise the "Instructions in Rifle and Carbine Firing for the United States Army," prepared by Captain Stanhope E. Blunt, Ordnance Department, Inspector of Rifle Practice at the Headquarters of the Army.

The junior member will act as recorder.

* * * * *

By command of

Lieutenant-General SHERIDAN,

(Sgd.) R. C. DRUM,

Adjutant-General.

OFFICIAL

(Sgd.) THOMAS WARD,

Assistant Adjutant-General.

CHICAGO, ILL., January 10, 1885.

The Board met pursuant to the foregoing order on January 5, 1885.

Present, all the members.

The Board held daily sessions until January 10th inclusive, examining the "Course of Instruction in Rifle and Carbine Firing," submitted by Captain S. E. Blunt, Ordnance Department, also various recommendations and papers submitted by members of the Board, also numerous communications from other officers of the Army.

The slight revisions the Board deemed necessary or advisable have, without dissent, been incorporated in the course of instruction submitted for their consideration, and they have the honor to recommend that it be authorized and published for the guidance of the Army in rifle and carbine firing.

(Sgd.) S. E. BLUNT,
Captain of Ordnance, President.
(Sgd.) WILLIAM C. MANNING,
1st Lieutenant, 23d Infantry.
(Sgd.) GEO. D. WALLACE,
1st Lieutenant, 7th Cavalry, Recorder.

FIRST ENDORSEMENT.

HEADQUARTERS OF THE ARMY,
WASHINGTON, January 15, 1885.

Respectfully submitted to the Secretary of War. The report of the Board of Officers convened by orders from Headquarters of the Army, dated December 11, 1884, is approved, and their recommendation that the "Instructions in Rifle and Carbine Firing for the United States Army," prepared by Captain Stanhope E. Blunt, Ordnance Department, Inspector of Rifle Practice at these Headquarters, be authorized for the guidance of the Army is concurred in.

(Sgd.) P. H. SHERIDAN,
Lieutenant-General.

Approved.

(Sgd.) ROBERT T. LINCOLN,
Secretary of War.

WAR DEPARTMENT,
February 3, 1885.

**HEADQUARTERS OF THE ARMY,
ADJUTANT-GENERAL'S OFFICE,
WASHINGTON, December 10, 1888.**

The revision of the work of Captain S. E. Blunt, Ordnance Department, Inspector of Rifle Practice at these Headquarters, which he has prepared, will be referred, for examination and report, to the Board of Officers which was convened by Special Orders No. 14, Headquarters of the Army, dated Washington, January 18, 1888, to prepare a system of infantry tactics, a system of cavalry tactics, and a system of light artillery tactics for the use of the armies of the United States.

By command of
Major-General SCHOFIELD,
(Sgd.) J. C. KELTON,
Assistant Adjutant-General.

THIRD ENDORSEMENT.

WASHINGTON, D. C., December 19, 1888.

Respectfully returned to the Adjutant-General, U. S. Army, inviting attention to the following action of the Board on the Preparation of Tactics:

The Board being in session December 12th, present all the members, proceeded at 2 P.M., in compliance with second endorsement, to the consideration of the modifications to be made in Blunt's Rifle and Carbine Firing.

The Board having fully considered the modifications proposed by Captain S. E. Blunt, Ordnance Department, and also the amendments suggested by members of the Board, finds that the modifications proposed meet the present requirements of rifle, carbine, and revolver firing, and unanimously recommends that they be embodied in the work, and that a new edition be prepared for the use of the Army and the National Guard of the different States.

The Board also recommends that the title of the new work be "Firing Regulations for Small Arms."

- (Sgd.) J. C. BATES,
Lieutenant-Colonel, 13th Infantry, President.
- (Sgd.) GEO. B. SANFORD,
Major, 1st Cavalry.
- (Sgd.) H. C. HASBROUCK,
Major, 4th Artillery.
- (Sgd.) J. T. HASKELL,
Captain, 23d Infantry.
- (Sgd.) JNO. C. GILMORE,
Captain, 24th Infantry.
- (Sgd.) E. S. GODFREY,
Captain, 7th Cavalry.
- (Sgd.) J. M. LANCASTER,
Captain, 3d Artillery.
- (Sgd.) GEO. ANDREWS,
1st Lieutenant and Adjutant, 25th Infantry, Recorder.

FIFTH ENDORSEMENT.

HEADQUARTERS OF THE ARMY,
WASHINGTON, December 19, 1888.

Respectfully submitted to the Secretary of War; the unanimous recommendation of the Board approved.

(Sgd.) J. M. SCHOFIELD,
Major-General Commanding.

Approved as recommended by the Major-General Commanding.

By order of the Secretary of War.

(Sgd.) J. C. KELTON,
Assistant Adjutant-General.

ADJUTANT-GENERAL'S OFFICE,
December 20, 1888.

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FIRING REGULATIONS

FOR

SMALL ARMS

FOR THE

UNITED STATES ARMY.

INTRODUCTORY.

COURSE OF INSTRUCTION.—DUTIES OF OFFICERS.

1. THE object of instruction in rifle and carbine firing is to develop in a body of troops such a state of discipline, such a knowledge of the capabilities of their weapons and such accuracy in their use, as will in battle render their fire most effective.

2. For the accomplishment of this end the exercises of the individual soldier should be directed to the attainment of proficiency in the use of the rifle or carbine in all varieties of weather, at different objects, over every possible variety of ground, and at distances within the limit in which individual fire can in battle be generally employed to the greatest advantage; and the training of the men as a body should be so conducted as to give them experience and instruction in the classes of fire they would employ in the different stages of modern actions, and to afford to their officers opportunities for acquiring a thorough practical knowledge of the best methods of conducting and directing their fire.

2 FIRING REGULATIONS FOR SMALL ARMS.

3. The course of instruction then permits of three main divisions :

(1.) The Preliminary Drills and Exercises.

(2.) Individual Practice at Known Distances and in Skirmish Firing.

(3.) Range or Field Practice of the Company as a body.

To these should be added instruction in the estimation of distance and in the theoretical principles relating to rifle and carbine firing, and to its application in action.

4. The target year, during only a part of which firing will be conducted, will commence January 1st and terminate December 31st.

The portion of this year which at each military station is least adapted to, and which immediately precedes the instruction of the soldier upon the target ground, will be utilized in laying, by a thorough course of the preliminary drills, the only enduring foundation for future proficiency. The instructors will also improve this opportunity for explaining the different theoretical principles, as far as the capacity and interest of the men appear to render it advantageous ; and for conducting such exercises in estimating distances as may be necessary.

5. To fully utilize the skill possessed by any body of men in the use of their arms, thorough drill and a high state of discipline are necessary. An education in rifle firing alone will not properly prepare the soldier for the part he has to play upon the battlefield ; it will, therefore, not be allowed to engross his entire time, to the exclusion of his proper tactical instruction, but rather be concentrated into only a portion of the

year ; but that it may be prosecuted to advantage it will replace, so far as practicable, during that period the ordinary drills and exercises, which for this purpose will be materially relaxed ; this method will, moreover, by permitting his instruction in rifle firing to be the more continuously and systematically conducted, probably result in a higher state of proficiency.

6. The period assigned for individual and collective firing upon the range, known as the *practice season*, will for all Departments be two months in duration. The months or portion of months constituting this season will be selected by Department commanders for the different posts in their Department, no particular effort being made to so arrange the practice season that it shall be alike at all posts, or that it shall be the same at any post for the mounted and dismounted troops there stationed, except that in all cases it will terminate on or before October 31st, but rather determining it for each post by the varying climatic conditions. As these conditions will generally change somewhat from year to year, the practice season for each year will be selected annually before commencing firing, and having once been announced no change will be made in it for that target year for any reason, except the change of station or prolonged field service of a company ; in such a case, the time assigned for practice will be so changed by the department commander as to afford before October 31st two months, and no more, for firing.

7. The relative progress or proficiency of the individual soldier, and of different organizations, will be determined only by such firing as may be done during

the practice season. Care should therefore be taken that it includes only so much of the period between January 1st and October 31st of each year as is most favorable for target practice, and to exclude from it all the period when practice cannot be held with advantage.

8. The first part of the practice season will be devoted to the course of instruction in individual fire at known distances ; this will be followed by instruction in individual skirmish practice and the season concluded with the course of collective firing of the company in the skirmish and volley practice.

Revolver firing for cavalry will also be conducted in this period, especially during the second month.

9. The month immediately preceding the opening of the practice season will be devoted to the theoretical instruction of the soldier, and to a careful and thorough course of the preliminary drills, especial attention being paid to the gallery practice. In the case of recruits, including all those who have not had the benefit of the course of instruction in any previous season, this period will be doubled.

10. If further instruction in estimating distances, in addition to what may be given during range practice, is desired, some portion of the months of the target year, not included in the practice season, may, in the discretion of the Department or post commander, be utilized for that purpose.

11. During those months of the year not included in the practice season or required for the preliminary instruction of the soldier, advantage should occasionally be taken of favorable weather, and a limited amount of range practice conducted. This will prevent the

expert shot from deteriorating during the period of general cessation of firing, and will, moreover, afford him experience and instruction in firing under conditions often differing materially from those existing during the practice season, but yet similar to what might obtain at some period of a long campaign. The results of such additional firing will not be considered in determining the soldier's classification or the figure of merit of his company.

12. In each Department an Inspector of Small Arms Practice, selected with reference to his special fitness and practical qualifications for supervising the course of instruction, will be appointed, whose duty it will be to examine the regular reports of firings, and from these reports, and from personal inspections, each post and target range being inspected at least once each year if practicable, to keep the Department commander informed of the absolute and comparative degree of proficiency manifested by the troops of the various posts and companies in the Department.

13. For the amount of instruction received by their commands, and for the degree of proficiency which they manifest, post commanders will be primarily responsible, and it is expected that they will exact from the troops under their command the highest degree of proficiency attainable. It will be their duty to inaugurate and conduct the instruction of their officers in the general theoretical principles of the subject, and by frequent supervision of the preliminary drills and exercises, and of the target practice of the companies, to assure themselves that the captains and their assistants are thoroughly conversant with all the details of the course, that they conduct the in-

struction of their men with energy and judgment, and where any deviations are made from the prescribed methods of instruction, that they are only those best adapted to secure the most favorable results.

14. Post commanders will also exercise a direct supervision over all the practices of the company as a body, and particularly over the company skirmish and volley firing. At large posts, however, where an additional field officer forms part of the garrison, the post commander may delegate to him this particular duty and also the general supervision of the instruction in target practice.

15. Company commanders will so conduct the instruction of their non-commissioned officers, both in the general theoretical principles of rifle and carbine firing, and in the different details of the course, particularly in the preliminary drills, that they may be enabled to render intelligent assistance in the instruction of the company.

16. The education of the men in small arm firing will be under the immediate supervision of the company commander, assisted by his lieutenants and non-commissioned officers. The different steps in the general system of progressive instruction prescribed in the authorized course will be carefully followed, but the details of the various methods may be modified by the company commander, if the particular circumstances of any special case appear to render a change advisable.

17. Progress in rifle and carbine firing depending not only upon the method of instruction, but to a great degree upon the capabilities of the instructors,

it is essential that the company officers should themselves become proficient, not only in the theoretical but in the practical details of the subject. They will participate in the preliminary drills and exercises and in the other parts of the course; they will always attend target practice, firing with the men, and endeavoring to attain a position in advance of the company in proficiency with the rifle, carbine, or revolver.

18. If the preliminary drills and the higher principles of target firing are thoroughly taught, every soldier, unless he is subject to some physical defect, can by careful practice become so proficient in the use of his weapon as to make his fire at moderate distances—probably up to about 600 yards—fairly effective against individual objects; and a small proportion of the men will develop such an excellence as to extend these limits to 1,000 or 1,200 yards. Where a company consists of men who have reached this stage of proficiency, their collective fire, if properly directed, would be effective against masses of men at all distances up to at least 1,500 yards.

19. To attain this standard will, however, require on the part of the company officers a most earnest and energetic effort. They should endeavor to awaken the enthusiasm of their men and to foster the spirit of emulation; they should take all possible pains to avoid discouraging the poorer shots, reminding them that while at first they may seem to make but slight progress, yet that a careful attention to the instruction and advice that they receive will ultimately be amply rewarded. To the best shots they should afford every opportunity for practice and assist them in their efforts to perfect themselves for special firing.

20. While in the following pages the methods of instruction are often described in considerable detail, it is not intended that they should necessarily be implicitly followed. In many cases the company commander, directly present with his men, and noticing from day to day their peculiarities, can substitute other methods with advantage; but as these instructions offer a guide, which, if faithfully adhered to, will usually produce in any body of men a number of good shots, and will so educate a company that the effect of their fire at the different distances met with in action will be greatly increased, it is recommended that they be only departed from after due consideration.

PART I.

INTRODUCTORY.

21. AFTER the soldier has been instructed in the nomenclature of the rifle, the precautions necessary for its care and preservation, and, at least to some slight extent, in the general principles governing the motion of projectiles, he will be thoroughly exercised in the preliminary drills. This branch of the course of instruction comprises Sighting Drills, Position and Aiming Drills, and Gallery Practice.

CHAPTER I.

SIGHTING DRILLS.

22. FOR instruction in sighting, some form of rest, in which the rifle is securely held, but yet admits of adjustment in position, and in both a vertical and horizontal direction, will be found very convenient. When such a rest cannot be readily obtained, a tripod and a bag of sand, sawdust, grain, or bran affords a good substitute.

23. The legs of the tripod should be about 6 feet long, the sand-bag resting in the fork made by joining the legs about 8 or 10 inches from the top. The lower ends of the tripod legs should be pointed with iron to prevent the possibility of slipping on the floor of the barracks or gallery. The sand-bag should

be only loosely filled, for if the sand is packed tightly a good bed for the rifle cannot be obtained. Each company should be provided with 4 or 5 of these tripods and sand-bags in order that the instruction of several squads may be carried on simultaneously.

24. It is essential that the interest of the soldier be obtained and held. This can be best accomplished by limiting the duration of each drill to not more than 30 minutes, and by dividing the company into squads of 6 or 8 men each, and as the men become more proficient, by conducting in the different squads different steps of the gradual instruction, requiring the men to pass in succession from squad to squad as their individual exercises are completed. The squads should be taught by the non-commissioned officers, the company officers passing from squad to squad and examining and verifying the details of the instruction as it is imparted by their assistants.

If, in the opinion of the company commander, the non-commissioned officers are not themselves sufficiently instructed to properly teach the men, the captain, assisted by his lieutenants, will act as instructors.

25. The instructor will show the men the two points—the middle of the notch of the rear sight (or in the sight soon to be introduced the notch in the open sights and the centre of the aperture or peep in the leaf), and the top of the front sight—which determine the line of sight. They will be informed that these two points must be brought into line with the object aimed at, the rifle inclining neither to the right nor left.

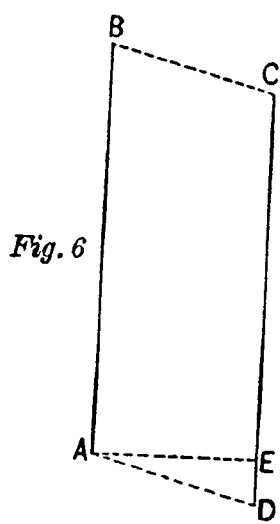
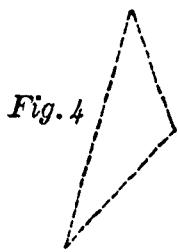
26. The attention of the soldier will be drawn to the

fact, that either the entire front sight, or any part of it, can be seen in looking through the notch or aperture in the rear sight; he will be informed that the proper amount of front sight to be taken varies somewhat with differences in light and is also considerably affected by peculiarities of individual eyesight. He should also be cautioned that regular results in firing can only be obtained when the sight is so taken as to give to the front sight, as seen through the notch of the rear sight, a uniform appearance.

27. To obtain this necessary regularity, either one of three forms of sight should be adopted: full sight (Plate I., Figure 1), where all the front sight down to the top of the bayonet stud is seen; fine sight (Plate I., Figure 2), where only the top of the front sight is seen over the bottom of the notch of the rear sight; and half sight (Plate I., Figure 3), where the top of the front sight is brought on the line of the top of the rear sight notch. (The diagrams of these sights should be shown to the soldier or should be drawn for him on a blackboard.) The fine sight can only be taken with accuracy when the light is strong; with the full sight there is more chance of lack of uniformity; the half sight, not requiring as much light as the fine sight and the horizontal line of the top of the notch of the rear sight affording a good guide for regularity, should by most men be adopted. When the aperture or peep is used, the top of the front sight should be brought up to the middle of the aperture of the rear sight.

28. The effect of the full sight is to cause a higher point of the object aimed at to be struck than if either of the other kinds of sight had been taken. The fine sight will cause a lower point to be struck.

PLATE I.



First Exercise.

29. The rifle being placed on the sand-bag rest, and inclined neither to the right nor left, the soldier will be instructed how to bring an object aimed at and the line of sight in the same straight line.

30. For this purpose the sand-bag rest being about 20 or 30 feet from the barrack wall, and the rifle directed at a large sheet of white paper on the wall, and about 5 feet from the floor, the instructor will direct a marker to so move a small black disk as to bring its lower edge in the line of sight. The disk, by a pin or tack, will then be attached to the paper.

31. The disk should be so large that it can be easily seen, as it is undesirable that the eye should be in any degree strained. One of the black pasters used in marking out shot-holes answers very well, in which case one edge of it can be lightly pasted to the paper.

32. The instructor will then inform the men that he has aimed at the lower edge of the disk, and whether with a full, fine, or half sight, and calling them up in succession, will direct them to close the left eye and with the right, looking through the rear sight at the object, to notice the relative appearance of the black disk and the points determining the line of sight. This instruction will be given with each variety of sight and with the rear sight adjusted for different distances up to at least 600 yards.

Second Exercise.

33. The rifle being placed as in the First Exercise, and the black disk having been brought as there explained into the line of sight, the instructor will call

up the men in succession, direct them to examine the sighting of the rifle and to inform him, in a low voice, whether a full, fine, or half sight has been taken. Those men who erroneously judge the kind of sight will be directed to examine it again and their attention brought to the details of the position.

34. The instructor will then slightly alter the position of the rifle and have the disk brought nearly, but not exactly into the line of sight. The men will then successively examine the sighting, and inform the instructor whether the line of sight—taking a full, fine, or half sight—passes to the right or left, above or below the lower edge of the disk. This exercise will be repeated for those who incorrectly estimate the direction of the line of sight, and for all with the rear sight adjusted for all different ranges.

35. Soldiers will sometimes be found who do not know how to place their eye in the line of sight; they often look over or along one side of the notch of the rear sight and believe that they are aiming through the notch because they see it at the same time that they do the front sight. This error will probably be made evident by the preceding exercise. Some men also in sighting will look at the front sight and not at the object. As this often occasions a blur, which prevents the object from being distinctly seen and increases both the difficulties and inaccuracies of sighting, it should be corrected.

Third Exercise.

36. In order to show to the soldier such irregularities in sighting as he may commit, the rifle and sheet

of paper on the barrack wall (or the sheet of paper may be advantageously replaced by a blackboard) being placed as in the preceding exercises, the marker is provided with a small rod bearing a disk of white card-board about 3 inches in diameter, with a black bull's-eye about half an inch in diameter, pierced in the centre with a hole just large enough to admit the point of a lead-pencil or of a chalk crayon.

37. A soldier is then called to the rifle and by the proper movement of his hands directs the marker to move the disk to the right, left, higher or lower, until the lower edge of the black centre is brought into the line of sight, when he says, "Mark." The marker then records through the hole in its centre the position of the disk; the marker lowers the disk, the soldier straightens himself a moment, and then, *without moving the rifle*, repeats the operation.

38. This exercise is performed 3 times, the points thus determined joined by straight lines, and the soldier's attention called to the triangle thus formed. The shape of this triangle and the position of its sides, will indicate the nature of the variations made in aiming. If the triangle is obtuse angled with its sides approaching the vertical (Plate I., Figure 4), the soldier has not taken a uniform amount of front sight; if the sides of the triangle (Plate I., Figure 5) are more nearly horizontal, the errors were probably caused by not looking through the *middle* of the notch of the rear sight, or not over the *top* of the front sight.

39. If any one of the sides of the triangle is longer than 1 inch, the instructor directs the operation to be repeated, verifying each sight and calling the soldier's attention to the errors which he commits.

He will explain to him that the sighting gains in regularity as the triangle becomes smaller.

40. If the sides of the triangle are so small as to indicate regularity in sighting, the instructor will place a small black circle so that its lower edge falls in the centre of the triangle--the circle should be as small as is compatible with distinct vision when looking through the rifle sights. The instructor will then examine the position of the circle with reference to the line of sight. If its lower edge is in the line of sight, the soldier aims correctly and with uniformity; if not in the line of sight, he aims in a regular manner, but with a constant error.

41. The cause of this error will, if possible, be determined and explained to the soldier. If the black circle is directly above its proper position, the soldier has taken, in aiming, too little front sight; or if directly below, too much front sight. If directly to the right or left, the soldier has not sighted through the centre of the rear sight-notch, and over the *top* of the front sight. If to the right, he has probably either sighted along the left of the rear sight-notch, or the right side of the front sight, or has committed both of these errors. If the black circle is too far to the left, he has probably sighted along the right of the rear sight-notch, or the left of the front sight, or has committed both errors.

If the circle is placed, with reference to its proper position, diagonally above and to the right, the soldier has probably combined the errors which placed it too high and too far to the right. Any other diagonal position would be produced by a similar combination of vertical and horizontal errors.

As the errors thus shown are committed when the rifle is fixed in position while that of the circle or target is altered, their effects will be directly opposite to the changes in the location of a hit in actual fire, occasioned by the same errors, when the target would be fixed and the rifle moved in aiming.

42. After this instruction has been given to one man, the position of the rifle will be slightly changed and the operations repeated with the others in the squad. This instruction will also be given with the rear sight adjusted for different ranges.

43. The preceding exercises in all the detail prescribed will only be necessary in teaching the use of the *two open sights*. When the *aperture*, or peep sight is employed, the soldier instinctively looks through its centre, and that class of error is therefore avoided. It is also much easier to take, with the aperture sight, a uniform amount of front sight, but as, however, variations in this particular can easily be made, the preceding exercises, even with the aperture sight, will still possess great value.

Fourth Exercise.

44. In the preceding exercises the soldier has been informed that the rifle should not be inclined either to the right or left; this precaution being taken in order that the rear sight may be kept vertical.

45. The necessity for this precaution, and also the general use of the rear sight, may be explained to the soldier by the instructor, or, if deemed advisable, may be directly illustrated; if the latter method is chosen,

the instructor will remove the barrel from the stock of one of the rifles and take out the breech screw. To mark the line of fire, he will place in the muzzle of the rifle a short, hollow cylinder of card-board, tightly fitting the barrel, and provided with two threads at right angles to each other and intersecting in the axis of the cylinder. He will also place in the breech a half circle with a small notch at the centre of its diameter.

46. The instructor will inform the soldier of the relation existing between the line of sight and line of fire as explained in Part VI., Chapter I. Then the rifle being placed as in the preceding exercises, the point where the line of sight (when the sight is adjusted for 200 yards) meets the paper is marked, and also the point where the line of fire meets the paper. If the rifle has not been inclined, the latter point will be in the vertical line through the former and above it. The rear sight will then, in succession, be adjusted for several longer ranges; the line of sight directed upon the mark designating its first position, and the points marked where the line of fire, in its different positions, meets the paper. The attention of the soldier will be called to the fact that each of these points is, in succession, further above the object aimed at, and he will be reminded that their distances above this point are proportional to those that a bullet would fall below the line of fire in traversing the actual range represented by the particular adjustment of the sight.

47. As in the Buffington rear-sight now in use the drift of the bullet is allowed for, the points in which the different lines of fire meet the paper, when this

exercise is conducted as prescribed above, will not lie in a vertical line through the point in which the line of sight meets the paper, but in one which inclines toward the left. The vertical distances of these points from that indicated by the line of sight will still have the value stated in the preceding paragraph, and their horizontal distances from the same origin will express, approximately, the relative amount of the drift for the different ranges. Approximately only, as the true drift curve cannot be indicated by a right line, though the correction can be given with all the exactness possible for military firing, by the form of sight adopted. If, as the different lines of sight are employed, the leaf is moved to the right, the number of points (see Part II., Chapter II.) required to compensate for the drift allowance, the points in which they meet the paper can all be brought into the same vertical line, and the principle illustrated in the same manner as when a sight without the automatic drift correction is used.

48. Adjusting the line of sight for one of the longer ranges, say 1,000 yards, neutralizing the drift adjustment as suggested in the preceding paragraph, and keeping the sights vertical, the instructor will mark the point where the line of sight and line of fire meet the paper; suppose that A (Plate I., Figure 6) is the former point, then some point, as B, on the vertical line through A, and above it, will represent the latter point; the distance A B will represent (it of course will not be equal to) the distance fallen by the bullet in traversing 1,000 yards, and A, the point aimed at, will be the point struck by the bullet.

49. Then incline the rifle to the right, and with the

sight thus inclined direct the line of sight upon A. Mark the position of the line of fire ; it will be found to meet the paper at some point, as C, to the right and below the point B. Lay off from C, on the vertical line through it, the distance C D equal to A B which represented the distance a bullet would fall below the line of fire for a range of 1,000 yards, and draw from A to C D the horizontal line A E. Then will D, a point to the right and below A (the point aimed at) be struck ; and A E will show the degree of error in direction, and D E that in elevation due to the inclination of the sights to the right. Supposing the rifle to have been at ten yards from the paper, then the range for which the sight is adjusted being 100 times as great ; the bullet will strike 100 times A E to the right and 100 times D E too low.

50. If the rifle be inclined to the left, the point struck by the bullet can in the same manner be shown to be below and to the left of the point aimed at ; inclining the sights therefore diminishes the range and causes deviation of the bullet to the side toward which the inclination is made.

51. During the course of sighting drill, the instructor should show the men how to adjust their sights for different distances and explain to them the value of the different divisions on the leaf, and the manner in which the corrections for drift are made. The use of the wind-gauge should also be explained and the changes made in the position of a hit by moving the gauge to the right or left.

CHAPTER II.

POSITION AND AIMING DRILLS.

52. THESE drills are intended to exercise the muscles, principally of the arms; to teach the proper methods of holding the piece and to give the soldier, whether standing, kneeling, or lying down, a perfect command of his rifle and an unconstrained position of the body. Also to teach steadiness both of person and rifle, and to establish between the hand and the eye such a prompt and intimate connection as will insure the finger acting upon the trigger at the proper moment, and without causing any derangement in the direction of the piece.

53. These drills should be divided into three exercises; the first, teaching the correct position and exercising the soldier in assuming it readily; the second, adding to the first exercise the accurate direction (or aiming) of the piece, and the retention of breathing; and the third, combining with the preceding the requisite steadiness of the rifle while pulling the trigger.

54. Until the men are able to execute with ease and accuracy all the details of the different exercises, they will be drilled in them by the numbers, or if without the numbers at the command of the instructor. After the requisite degree of proficiency is attained and the adoption of faulty positions on the part of the soldier therefore rendered improbable, the detailed commands will be omitted, the men repeating and continuing the practice of the exercise specified by

the instructor, without any effort to preserve the regular cadence of a military movement.

55. The squad being formed in single rank with an interval of one pace between files, arms at a carry or order, the instructor first cautioning the men not to cock the piece, commands :

1. *Squad*, 2. **READY.**

At the second command execute the first motion of *Ready* as prescribed in the Infantry Drill Regulations, the left hand being just below the lower band and the right hand grasping the small of the stock, the thumb inclined forward and diagonally to the left, the right foot carried about six inches to the rear, and three inches to the right (depending upon the size of the man), head and eyes turned to the front, body at half face to the right, erect, carried easily and naturally upon the hips, and equally supported upon both feet; toes turned slightly inward, both feet firmly on the ground and ball and heel pressing it equally.

56. (Two.) Carry the thumb across the small of the stock, and if the size of the hand will permit, pressing against the left side of the end of the middle finger, the second joint of the fore-finger resting lightly, but not pressing, against the trigger.

First Exercise.

57. To enable the instructor to notice and more readily correct any tendency of the soldier to incline the piece to either side, he will direct the men holding the piece firmly with the left hand, to raise with the right hand the leaf of the rear sight.

58. The men being at the ready, the instructor commands :

1. *First*, 2. EXERCISE.

At the latter command without moving the body, head, or eyes, raise the rifle smartly to the front of the right shoulder to the full extent of the left arm ; elbows inclined downward ; the barrel nearly horizontal ; muzzle slightly depressed, heel of the butt on a line with the top of the shoulder.

59. (Two.) Bring the piece smartly against the hollow of the shoulder, without permitting the shoulder to give way, press the rifle against it, mainly with the right hand, only slightly with the left ; the forefinger of the right hand resting lightly against the trigger ; the rifle inclined neither to the right nor left. At the same time bring the left elbow well under the rifle, the right elbow slightly advanced and raised to the height of the shoulder ; the head erect ; eyes to the front and not looking through the sights.

60. (THREE.) Resume the second position of the Ready.

Remarks.

61. The instructor should especially notice the positions of each soldier in this exercise, correcting every detail, if required, and endeavoring to give each man an easy and natural position. He should be careful to see that the men avoid the common error of drawing in the stomach, raising the breast or bending the small of the back. Also that the knees and toes are turned slightly inward, and the knees pressed backward by a slight tension of the calves so as to secure a firm hold for the feet.

PLATE II.

Fig. 1.

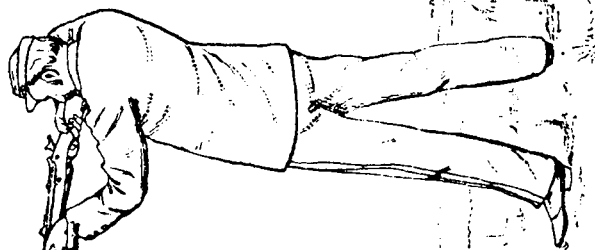
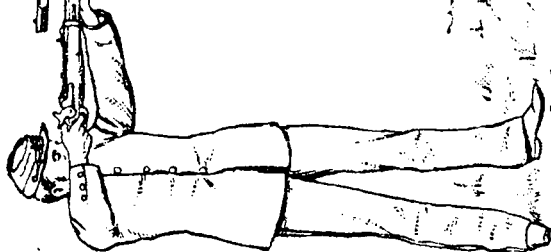


Fig. 2.



FIRING STANDING.

62. The soldier should be informed that the steadiness of the rifle and immunity from recoil, can only be secured by firmly pressing the piece into the hollow of the shoulder, not against the muscles of the upper arm; that in grasping the piece with the right hand the forefinger must be left free; that but slight effort should be made by the left arm to press the piece against the shoulder, but the arm left at liberty to give to the rifle its proper direction; and that the grasp of the rifle, while firm, must not be so tight as to communicate to it the pulsations of the body. As the nature of the recoil and the position of the point hit are affected by the manner in which the butt of the piece is held against the shoulder, the instructor should be careful to see that neither the heel nor the toe of the butt alone, but that its whole surface is pressed against the shoulder, and that it is brought uniformly to the same position.

63. Many riflemen prefer for the standing position what is termed the body rest (this position as assumed for firing is illustrated in Plate III., Fig. 1), the left elbow resting against the body and as far to the right as it can be placed with ease; the left hand grasping the rifle just in front of the trigger guard, with the little finger resting against the bottom of the thumb-piece of the cam-latch. The exact position of the left hand will, however, depend greatly upon the length of the upper arm. In some cases the first, or the first and second fingers of the left hand, instead of grasping the piece, are extended forward under the barrel.

64. Whether this position gives increased steadiness depends somewhat upon the conformation of the man.

When it can be easily taken, it generally enables the soldier, firing in calm weather, to hold the rifle for a longer period upon the mark, and in that respect possesses a great advantage. In a side-wind or in taking aim very quickly, or at moving objects, its adoption probably results in a slight loss of control over the piece.

65. Men with very short arms and neck may find it advantageous, while resting the left elbow against the body, to turn the wrist so as to bring the thumb against the trigger-guard, the fingers extending to the front under the barrel. This position (Plate III., Fig. 2), while exerting less strain upon the muscles than that described in paragraph 63, yet brings the left arm more directly under the rifle.

66. Some riflemen prefer to extend the left arm nearly to its full extent, moving the left hand to the front as the piece is raised to the shoulder; this position (Plate II., Fig. 2) probably gives the best control over the rifle when firing in a strong wind or at moving objects. It also possesses advantages when a rapid as well as accurate delivery of fire is desired.

67. When rifles are provided with the pistol grip, it is not necessary, in order to obtain a firm grasp of the piece, and pressure against the shoulder, to place the thumb over the small of the stock; if the thumb is extended along the right side of the stock, greater mobility will be given to the forefinger; the rifle will be more readily kept level and the pull upon the trigger will be less liable to divert the rifle to the right.

68. Whenever from any defect of vision in the right eye, or from any other peculiarity of the man, he can aim more accurately, or take an easier position by bringing the rifle to the left instead of the right

PLATE III.

Fig. 1.

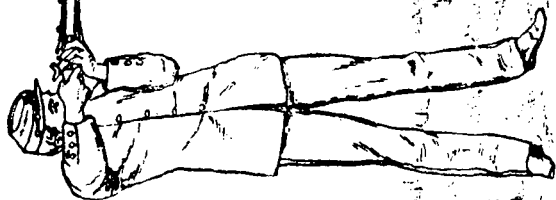
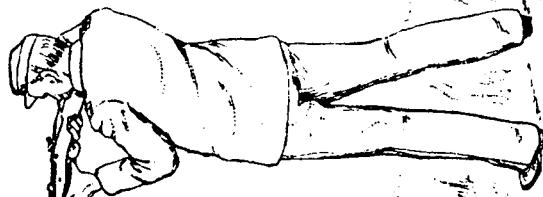


Fig. 2.



FIRING STANDING—BODY REST.

shoulder, this modification of these positions should be permitted.

69. As the particular variety of position best adapted to each soldier depends greatly upon the conformation of the man and his individual peculiarities, the instructor should, by exercising the men in the various positions described, or in such modifications of them as he deems proper, determine those which each man should permanently adopt.

70. As soon as the men have acquired with accuracy their positions, they will be exercised without the numbers. The exercise will also be frequently repeated and made continuous; the instructor prefacing the command, *First Exercise*, by the command: *Continue the motion*, and giving the command THREE, for its conclusion, when the soldier will return to the *ready*. From the exercise in this form the greatest advantage will be obtained.

71. The instructor will suspend the drill by the command,

1. *Carry*, 2. ARMS.

which will be executed as prescribed by the Infantry Drill Regulations.

Second Exercise.

72. For this exercise the instructor will place the men as for the *first exercise*, and facing the barrack wall, and about 20 feet from it. On the wall opposite each man, and about 4½ feet from the floor, will be placed a small black disk (a black target paster answers excellently) on a white background.

73. The instructor will first direct the sights to be

adjusted for the 100 yards range, and subsequently for the different longer ranges, with the leaf raised.

74. The instructor commands :

1. *Second*, 2. EXERCISE.

At the latter command execute the first motion of the *first exercise*.

(Two), Execute the second motion of the *first exercise*, except that the head should be bent slightly forward and a very little to the right ; the cheek resting against the stock ; the left eye closed ; the right eye looking through the notch of the rear sight at a point about a foot below the mark, and the top of the front sight aligned upon that point.

75. (THREE), Draw a moderately long breath, permit a portion of the air to escape from the lungs, and retaining the remainder, slowly raise the rifle with the left hand, being careful not to incline the sights to either side, until the line of sight meets the lower edge of the mark ; hold the rifle steadily directed on that point for a moment, then, without command and just before the power to hold the rifle steadily is lost, drop the rifle to the position of *ready* and resume the breathing.

Remarks.

76. Some riflemen prefer in aiming to lower the rifle to the object rather than to raise it as here prescribed. It is possible that for some men this may give greater steadiness, but it is not generally recommended, as it undoubtedly possesses the disadvantage of preventing the final point of aim being kept in view during the motion of the rifle.

77. The eye may be brought to the line of sight either by lowering the head or by raising the shoulder; it is best to combine somewhat these methods; the shoulder to be well raised by raising the right elbow and holding it well to the front and at right angles to the body, the head when inclined forward being only very slightly bent to the right. When the shoulder is well raised, the blow upon the mouth or nose which otherwise may be given by the recoil is avoided. The length of the soldier's neck determining greatly the exact method of taking the proper position, the instructor will be careful to see that the position is taken without constraint.

78. As changes in the elevation of the rear sight will necessitate a corresponding change in the position of the soldier's head when aiming, the exercise should not be held with the sight adjusted for the longer ranges until the men have been practised with the sights as they would generally be employed for off-hand firing.

79. The soldier must be cautioned that while raising the line of sight to the mark, he must fix his eye on the mark and not on the front sight; the latter can then be readily brought into the line joining the rear sight notch and mark. If this plan be not followed, when firing is held on the range at long distances, the mark will generally appear blurred and indistinct. The front sight will always be plainly seen, though the eye is not directed particularly upon it. The soldier will also be cautioned to exercise the utmost care to always take in aiming the same amount of front sight.

80. The rifle must be raised slowly, without jerk,

and its motion stopped gradually. In retaining it directed at the mark, care must be taken not to continue the aim after steadiness is lost; this period will probably be found to be short at first, but will quickly lengthen with practice. No effort should be made to prolong it beyond the time that breathing can easily be restrained. Each soldier will determine for himself the proper time for discontinuing the aim.

81. The men must be cautioned not to draw and retain too long a breath, as a trembling of the body would, in many cases, result.

82. Some riflemen prefer, in aiming, to keep both eyes open, but unless the habit is fixed the soldier should be instructed to close the left eye.

83. As soon as the men have acquired the details of this exercise, they should be practised in it without the numbers and afterward at will, the instructor prefacing his command by the command: *Continue the motion*, the ready being resumed at the command, *READY*, and the carry as prescribed in the *first exercise*.

Third Exercise.

84. The men being placed as for the *second exercise*, the instructor commands:

1. *Third*, 2. EXERCISE.

At the preparatory command the soldier will cock the piece, and at the latter command and at the command *Two* will execute the first and second motions of the *second exercise*.

85. (*THREE*), Draw a moderately long breath, as in the *second exercise*, and raise the rifle as there pre-

scribed ; then as soon as the rifle is held steadily on the mark, but not before that time, contract the first finger gradually, and without any assistance from the hand or arm slowly and steadily increase the pressure upon the trigger ; continue the gradual increase of pressure, so that when the rifle seems to be held most steadily upon the mark and the soldier thinks he can continue the aim for a moment longer, the additional pressure required to release the point of the sear from the tumbler can be given almost insensibly and without causing any deflection of the rifle. Continue the aim a moment after the fall of the hammer, observe if any change has been made in the direction of the line of sight, and then resume the *ready*.

Remarks.

86. The intimate connection between the mind and the action of the forefinger on the trigger ; and the prompt and uniform response of the finger to the will, so requisite for the successful performance of this exercise, can only be acquired by careful practice. Every soldier should have a thorough acquaintance with the trigger-pull of his rifle in order that he may at any moment know how much additional pressure will be required for its discharge.

87. Too much attention cannot be paid to the effort to exert this pressure gradually and without jerk, the trigger at all times being rather squeezed or pressed than pulled, and the requisite final additional pressure being so slight as to require hardly any exertion for its accomplishment.

88. Many authorities on rifle firing advocate com-

mencing the pressure upon the trigger as the rifle is being raised and giving the final pressure as soon as the sights cover the mark, reasoning that the upward motion of the barrel will have prevented any lateral motion of the piece, which a delay would afterward render probable. If the first sight thus obtained is a good one, or the trigger-pull very light, it is probably the best method, but with the ordinary trigger-pull of the military rifle, the effort to discharge the piece at the precise moment the aim is first obtained too often results in a jerk, with all its consequent errors, rather than a gradual pressure upon the trigger. With practice the rifle can be held, for a limited period, directed upon the mark; this art should have been acquired by the second exercise, and if it has been, the trigger can generally receive its final pressure very gradually and at an instant when no previous motion of the rifle can tend to produce haste.

89. If the trigger has been pulled with a jerk instead of a gradual pressure, the muzzle of the rifle will probably be diverted to the right, or possibly downward at the moment of firing; it is with the object of discovering this error, if made, that the aim is continued after the hammer has fallen and the exact point noticed where the rifle is then directed. If at some point other than the mark, every effort should be made by the soldier, during assiduous practice at this exercise, to avoid pulling the trigger with a jerk. If the habit cannot be overcome, or if a constant deflection of the line of sight appears at the moment of discharge, the nature of the allowance which must be made for this error by means of the rifle-sight, when firing with ball cartridges, should be explained to the soldier.

90. Many men have a tendency to close the right eye as the hammer descends; this habit, if not overcome, will result in entirely losing the aim and pulling the trigger with a jerk.

91. Some riflemen advocate the employment of the second finger upon the trigger; this has the tendency to apparently lessen the amount of force required to discharge the piece, and for men with very long arms or fingers may be the easiest position.

The loss of the greater mobility and sensitiveness of the forefinger is, however, a positive disadvantage.

92. As in the previous exercises, as soon as the soldier has acquired the details of the movement, he should be practised in aiming and pulling trigger, according to this exercise, without the numbers, and also at will.

93. As the third exercise embraces all that is taught in the second exercise, after the soldier has become proficient in the latter, his drill may be confined to the *first* and *third exercise*. He should be encouraged to go through these exercises frequently at other than drill hours, care being taken that for the third exercise he always has some definite object for a mark.

POSITION AND AIMING DRILLS.—KNEELING.

94. To practise the soldier in the preceding exercise in the kneeling position, the squad being formed in single rank with an interval of one pace between files, arms at an order, the instructor commands:

1. *Prepare to Kneel*, 2. **KNEEL.**

At the command *Kneel* execute a half face to the right, carrying the right foot so that the toe shall be

about 10 inches to the rear and 10 inches to the left of the left heel ; at the same time bend both knees, kneeling on the right, the left lower leg nearly perpendicular, left toe inclining slightly to the right, right leg pointing directly to the right, right foot nearly vertical and weight of the body resting firmly on the right heel ; body erect and carried naturally upon the hips, though some riflemen prefer to incline the body somewhat to the front ; the left forearm across the left thigh, hand hanging naturally ; the piece remaining in the position of order arms ; the right hand grasping it above the lower band.

The instructor (cautioning the men not to cock the piece) will then command,

1. *Squad*, 2. **READY.**

which will be executed as prescribed by the Drill Regulations.

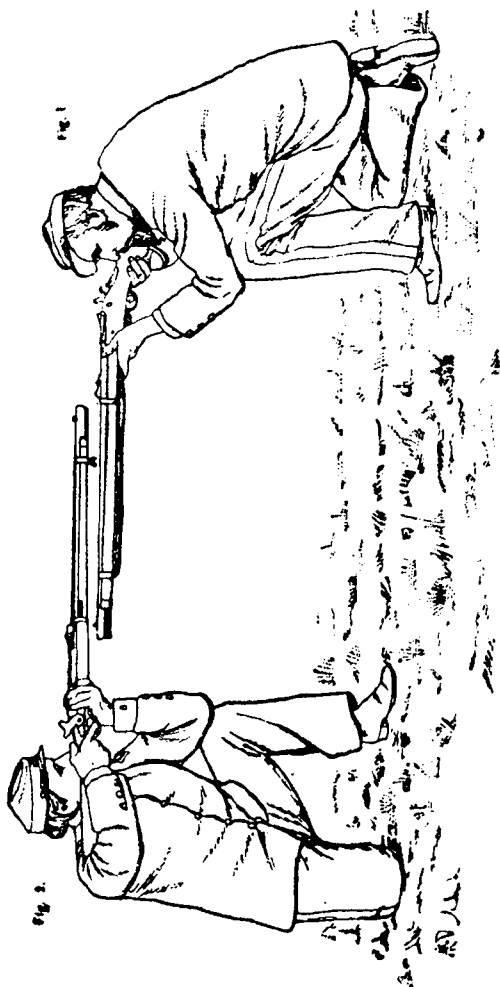
95. The instructor then directs the men as in paragraph 57 to raise the leaf of the rear sight, and then commands :

1. *First*, 2. **EXERCISE.**

which will be executed as prescribed in paragraphs 58, 59, and 60, except that at the command *Two* the soldier will rest the left elbow on the left knee, the point of the elbow in front of the knee-cap. The exercise will be further conducted as prescribed in paragraph 70.

96. For the *Second* and *Third Exercises*, the squad will be placed as directed in paragraph 72, the bull's-eye being $2\frac{1}{2}$ feet from the floor or ground. The exercises will be conducted as prescribed for the cor-

PLATE IV.



FIRING KNEELING.

responding exercises, standing, with the modification indicated for the *First Exercise, Kneeling*.

97. On the completion of the exercises the instructor will command,

1. *Squad*, 2. *RISE*.

when the men rise, face to the front, and resume the position of order arms.

98. Frequent rests will be given during practice in these exercises kneeling, as the position, if long continued, becomes constrained and unnecessarily fatigues the soldier.

Remarks on the Kneeling Positions.

99. In raising the rifle to the mark in the second and third exercises, the position of the left hand should not be changed, but the left forearm should be bent toward the body and at the same time the body bent slightly to the rear.

100. When aiming kneeling there is, from the nature of the position, a tendency to press the butt of the rifle against the upper arm instead of against the hollow of the shoulder; this will necessitate inclining the head considerably to the right, to get the line of sight, and by bringing the rifle so far to the rear will, if the thumb is placed across the stock, cause it to give by the recoil a blow upon the nose or mouth.

These difficulties can be avoided by advancing the right elbow well to the front, at the same time raising it so that the arm is about parallel to the ground. The hollow of the shoulder will then be the natural place for the rifle-butt, and the right thumb will be

brought too far from the face to strike it in the recoil.

101. The kneeling position previously described (Plate IV., Figs. 1 and 2) is not an easy one if a thin-soled shoe is worn by the soldier; but with the thick, stiff sole of the uniform shoe the necessity for bending the muscles of the foot will be avoided, and the weight of the body being supported mainly by the shoe, the muscles of the foot and ankle are not strained, and with but little practice the position becomes easy and natural. It possesses for most soldiers greater advantages than any other.

102. Some riflemen prefer, by bending the ankle, to rest the instep flat on the ground, the weight of the body coming more on the under part of the heel, this obviates any tendency of the right knee to slip; or by resting the right side of the foot on the ground, toe pointing to the front (Plate V., Figs. 1 and 2), to bring the weight of the body on the left side of the foot. In both of these modifications of the position the left elbow is brought lower, and a consequent extension to the front of the left foot and leg rendered necessary; this prevents the knee affording as steady a rest for the left elbow and rifle as in the first prescribed position, but if it can be taken without constraint, gives a very steady position for the body.

103. In the off-hand or standing position, the soldier will be able, after some practice, to overcome to a great extent the lateral motion of his piece, and except for the vertical vibrations to hold it steadily upon the mark; but as soon as these exercises are begun in the kneeling position, it will be noticed that the lateral movements of the rifle are now the greater, the rest

PLATE V.

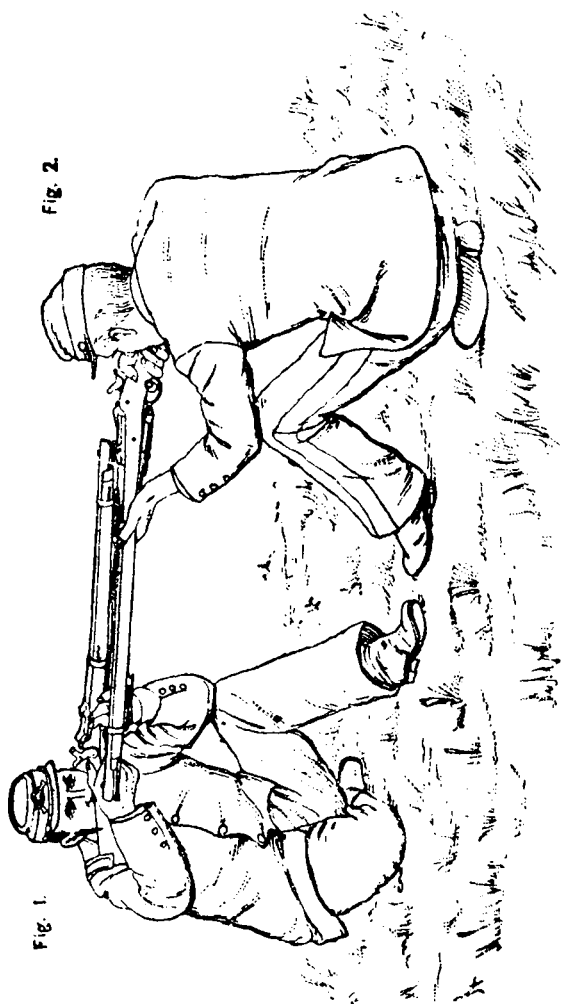


Fig. 1.

Fig. 2.

FIRING KNEELING.

afforded by the knee diminishing the vertical errors. This will require renewed efforts on the part of the soldier to hold the rifle steadily.

104. In firing kneeling the principal difficulty encountered is one of position, the proficiency attained depending greatly upon the variety of position adopted and the degree of steadiness of the body and freedom from constraint which results. The peculiarities of formation of the individual soldier exert, when firing kneeling, a greater influence than when firing either standing or lying down; the instructor should therefore carefully endeavor, noticing the build of each soldier, to place him in the position for which he is best adapted and which will exert the least undue tension or strain upon the muscles.

105. While steadiness in kneeling is not easily acquired, yet by constant practice it can be attained, and to a degree not generally equalled for off-hand firing. It thus becomes possible, if the preliminary exercises have been assiduously followed, to reach, when firing kneeling, a proficiency nearly or fully equal to that attained when firing from the standing position at the same sized object at a shorter range.

POSITION AND AIMING DRILLS.—SITTING DOWN.

106. In some instances the conformation of the soldier may be such that no form of kneeling position can be taken without constraint; in other cases the men, while able to kneel and hold the piece moderately steady, can yet in a sitting position obtain much better results. All should therefore be instructed in aiming sitting down as well as from a kneeling position.

PLATE VI.



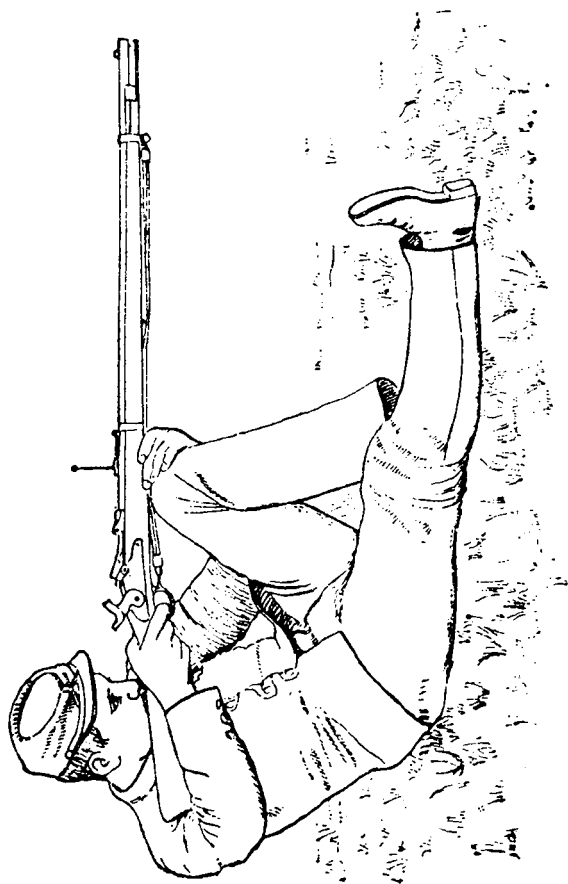
Fig. 1.



Fig. 2.

FIRING SITTING DOWN.

PLATE VII.



FIRING SITTING DOWN.

107. To practise the soldier in the preceding exercises in a sitting position, the squad being formed in single rank, with an interval of one pace between files, the rifle should first be brought to an *order arms*; the instructor then commands:

1. *Squad*, 2. *SIT DOWN*.

At the command *Sit Down*, make a half face to the right and, assisted by the left hand on the ground, sit down, facing slightly to the right, the left leg directed to the front, right leg inclined toward the right, both heels, but not necessarily the bottom of the feet, on the ground, the right knee slightly higher than the left; body erect, and carried naturally upon the hips; at the same time drop the muzzle of the piece to the front, and to the position of *ready* (not cocking the rifle), right hand upon the thigh, just in front of the body, the left hand slightly above, but not resting upon the left leg.

108. The instructor then directs the men as in paragraph 57 to raise the leaf of the rear sight, and then commands:

1. *First*, 2. *EXERCISE*.

which will be executed as prescribed in paragraphs 58, 59, and 60, except that at the command *Two* the soldier will rest the left elbow on the left knee, the point of the elbow in front of the knee-cap, and the right elbow against the left or inside of the right knee, at the same time inclining the body from the hips slightly forward. The exercise will be further conducted as prescribed in paragraph 70.

109. For the *Second and Third Exercises* the squad

will be placed as directed in paragraph 72, the bull's-eye being 2 feet from the floor or ground. The exercises will be conducted as prescribed for the corresponding exercises, standing, with the modifications indicated for the *First Exercise, Sitting Down*.

110. On the completion of the exercises, the instructor will command:

1. *Squad*, 2. *Rise*.

when the men rise, face to the front, and resume the *order arms*.

Remarks on the Sitting Positions.

111. If the preceding position (Plate VI., Fig. 1) is carefully practised, steadiness is quickly attained. It will be found advantageous to make a slight hole in the ground for the heels, which will prevent any tendency of the foot to slip to the front. The right leg should not be carried so far to the right as not to afford a good support or brace for the right elbow.

112. This position can be modified, but in the general case, not without impairing the steadiness of the man by crossing the legs at the ankle (Plate VI., Fig. 2), the outside of each foot resting upon the ground, body more erect, and the knees slightly more raised than in the previous position.

113. In raising the rifle to the mark, the directions of paragraph 99 should be followed.

POSITION AND AIMING DRILLS.—LYING DOWN.

114. From the nature of the position, it is not practicable to execute the preceding exercises accord-

ing to the method followed when standing or kneeling; instruction will, however, always be given with reference to the position, and to the manner of assuming it, and to aiming and pulling trigger.

115. For this purpose, the squad being formed as specified in paragraph 72 (and the black disks there mentioned being about twelve inches from the floor), the squad will be brought to an *order arms*.

116. Then being at an order either standing or kneeling, the instructor commands:

1. *Prepare to Lie Down*, 2. *LIE DOWN*.

If standing, first execute what has been explained for the position of *kneel*, as prescribed in paragraph 94. The movement will then be continued at the command:

(Two), When the soldier will draw back the left foot and place the knee on the ground; place the left hand well forward on the ground, and lie flat on the belly; lowering the piece at the same time with the right hand, the toe and muzzle resting on the ground, the barrel up, the left hand at the lower band, the left elbow on the ground, the right hand at the small of the stock, opposite the neck.

117. Having taken the position as prescribed in the preceding paragraph, the legs should be inclined well to the left, and either crossed or separated as the soldier prefers or his particular conformation appears to render most desirable, and the body at the same time inclined very slightly to the right.

If care is exercised a position of steadiness and ease can thus, with practice, be quickly assumed.

PLATE VIII.



FIRING LYING PRONE.

118. The instructor then directs the men to raise the leaf of the rear sight, and then commands :

1. *Third*, 2. EXERCISE.

At the preparatory command the soldier will cock the piece.

119. At the latter command carry the left elbow to the front and slightly to the right ; the left hand under the barrel in front of the lower band ; weight of the body mainly supported by the left elbow, the right resting lightly on the floor or ground.

120. (Two), Slide the rifle with the right hand through the left hand to the front, until the left hand is a little in front of the trigger-guard ; at the same time raise the rifle with both hands and press it against the hollow of the shoulder.

121. (THREE), Direct the rifle upon the lower edge of the black disk, and carry out the further details of aiming and pulling the trigger as prescribed in paragraph 85.

Then resume the position given in paragraph 117.

122. As soon as the men have acquired with accuracy the details of the position (Plate VIII.), they will be practised, without the numbers, aiming and pulling trigger at will ; but care will be taken not to unduly prolong the exercise.

123. To afford the men rest, or on completion of the exercise, the instructor will command :

1. *Squad*, 2. RISE.

when the men rise, by reversing the order of the details of paragraph 116, and resume the position order arms.

Remarks on Positions for Aiming Lying Down.

124. The preceding position for firing lying down, generally known as the prone position, does not afford to the person or rifle the same degree of steadiness that is given by some of the back positions; it is, however, the only one that has yet been subjected to the test of trial in action. It possesses, in a greater degree than other positions, the merit of adaptability to changes in the configuration of the ground; it enables the soldier to deliver fire over low breastworks or improvised shelters and rests, and affords him a better view over the ground which separates him from his mark, and a very much greater arc of fire without altering the position of the body, than can be obtained from any back position.

It is, therefore, by no means determined because the back positions possess advantages for target firing, that they will be universally used in action, and instruction in the use of the prone position will therefore be given not only in the preliminary exercises but also in range firing.

125. In the prone position, when aiming, the left elbow should be under or slightly to the right of the barrel, the other elbow somewhat to the right but not so far as to induce any tendency to slip on the floor or ground; the hips and legs turned well to the left, the right foot crossed over the left ankle; or some prefer the legs separated and the toes turned outward to bring the body closer to the ground; the head elevated; the right shoulder well raised and the rifle pressed firmly against it with both hands.

126. The greater changes in elevation required in

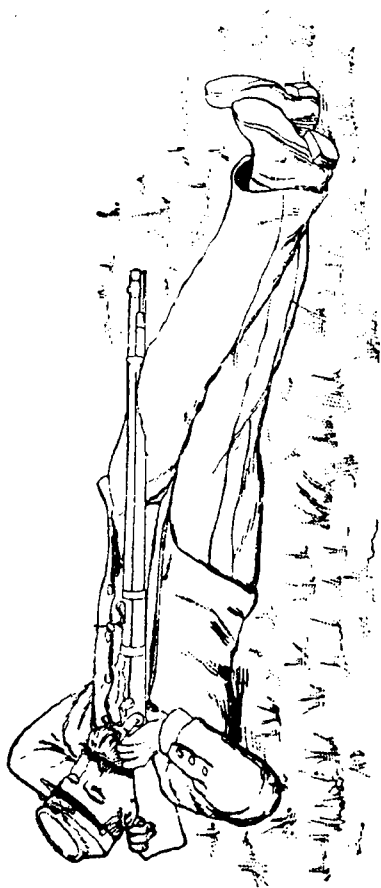
first directing the rifle on the object, should be given by altering the position of the left hand under the barrel; the slighter changes only by advancing or withdrawing the shoulder.

127. The body not yielding to the recoil as when firing standing or kneeling, its force, if the rifle is not properly held, may severely bruise the soldier. It is one of the objects of this exercise to so teach him that this will be prevented. Care must be exercised that the butt is not brought against the collar-bone; this is avoided by curving the body and legs to the left. By moving the shoulder slightly to the front or rear, and by moving the right elbow from the body or toward it, each soldier can determine the position in which the shoulder gives to the butt of the rifle the easiest rest. This will probably be the one in which the force of the recoil will be least experienced.

128. For target firing, lying down, the best results can generally be obtained by assuming one of the back positions. The particular one that should be adopted by the soldier depends greatly upon his conformation. Unless unusually stout, of small stature, or with very short arms, the position of Sergeant Tabler, 22d Infantry, usually known as the "Texas grip," and described below, should be taken (Plates IX. and X.).

129. Assisted by one hand on the ground, sit down, facing to the front; lengthen the gun-sling slightly, and pass the left foot and leg through the sling until the rifle rests just above the left knee; cross the left leg over the right at the knee and lie down on the back with both hips, both shoulders, and the right leg flat and firm on the ground; draw the piece to the rear,

PLATE IX.



FIRING LYING DOWN—"TEXAS GRIP."

PLATE X.



FIRING LYING DOWN—"TEXAS GRIP."

the stock below the guard-plate resting on the right shoulder well out from the head ; place the left arm under the head, back of the hand up, fingers grasping the top of the butt, thumb behind the butt-plate near the head ; rest the cheek against the side of the stock, and the head on the back of the left hand and wrist and press the stock firmly down on the shoulder ; pass the thumb of the right hand as far as possible through the trigger-guard in front of the trigger, grasping the small of the stock with the fingers of the right hand, back of the hand up, little finger in rear of the hammer, and the right elbow resting firmly on the ground.

130. In this position, to insure greater steadiness and to take up the force of the recoil, the rifle should be drawn strongly to the rear, bringing the gun-sling firmly against the left leg just above the knee ; if the sling is not sufficiently lengthened, room will not be afforded for the fingers of the left hand on the butt ; if made too long, the interposition of the trigger-guard will prevent the stock being firmly pressed against the shoulder, and the thumb of the left hand, which generally serves to assist the fingers in correcting any canting of the rifle, cannot be placed behind the butt-plate without constraint.

131. Care should be exerted that the muscles of the legs are relaxed, the left leg, or knee not being raised but extended at full length over the right.

The muzzle can be depressed by withdrawing the right leg somewhat from under the left ; it can be elevated by passing the right leg further under the left and by straightening the neck, thereby pressing the stock further down on the shoulder.

132. The pull on the trigger should be given by gradually tightening the grasp of the right hand and pressing steadily against the lower part of the trigger with the base of the thumb.

133. An excellent back position, where the use of the gun-sling is not essential, can be obtained by raising the left knee until the lower leg is nearly vertical; the left foot flat on the ground and close to the body (Plate XI.). Cross the right leg over the left so that the calf shall press firmly against the left ankle, the side of the right foot being on the ground, and rest the muzzle of the rifle in the crotch thus formed. Place the left arm under the head, back of the hand to the rear, butt-plate resting in the palm of the hand, fingers on the right side of the stock, thumb under the toe of the butt; rest the head on the left wrist and press the stock firmly down on the shoulder. The right elbow on the ground, well out from the body, right thumb across the small of the stock, forefinger against the trigger.

134. For the average man the rifle in this position, which is usually known as the Fulton position, is entirely clear of the body, and it therefore can be more readily assumed by men of stouter build than the position previously described. It possesses, however, the disadvantage not shared by the former position, of requiring a tension instead of relaxation of the muscles of the legs, and therefore does not so readily afford an immovable rest for the muzzle of the rifle. The rifle is also brought further to the front, and the rear sight therefore carried further away from the eye.

135. The position described in paragraph 133 is sometimes modified by raising the right knee to the

PLATE XI.



FIRING LYING DOWN—FULTON POSITION.

level of the left, the soles of both feet resting on the ground, and the muzzle of the rifle held between the legs, about half way between the knee and ankle. This position is also, for the reasons mentioned above, considered by many as inferior to that described in paragraphs 129 and 130.

136. Still another modification of this position is obtained (Plate XII.) by placing the legs about as prescribed for the Fulton position, the body being brought, however, very slightly more upon the right hip, the right elbow resting upon the ground, the right forearm turned to the rear, the hand grasping the butt behind the ear, the left arm across the body with the thumb of the left hand upon the trigger, and the fingers over the small of the stock. In this position the right arm, if the elbow is placed far enough forward, experiences the recoil as a strain of tension and firmly sustains it, and by moving the rifle, when assuming the position, far enough to the front there will be no danger of the left hand striking the chin when the piece is discharged.

137. Another back position is obtained by lying slightly on the right side, the right leg extended, left leg slightly drawn up, with the knee a little upon the side of the right knee, the right foot crossed over the left ankle, the rifle barrel resting upon the left leg, the butt between the right arm and breast, and pressed up under the armpit, the forefinger upon the trigger, right elbow upon the ground. The head may be held steady by passing the left hand beneath it, or it may be left unsupported. If not used to sustain the head, the left hand should grasp the piece at the small of the stock and assist in the steady pressure against the



FIRING LYING DOWN.

shoulder. In any form of this position the rear sight is kept at some distance from the eye, and it may be found necessary for distinct vision to slightly widen the aiming notch.

138. Still another back position is taken by turning slightly on the right side, with the right leg slightly drawn up, back of heel on the ground, left foot passed through the sling and pressed hard against the top of the right foot, left knee against the right and slightly overlapping it. Butt of gun drawn under the right armpit, muzzle resting on right toe, right elbow on the ground, forefinger on trigger, left hand grasping the stock, near the head, and the left sleeve caught in the mouth to support the head.

139. Various other positions for firing lying down are illustrated in Plates XIII., XIV., XV., and XVI. The instructor, taking into consideration the conformation of each man, should endeavor to give him an easy and natural position according to some one of the described or illustrated methods, or in such modifications of them as he may deem best suited to the peculiarities of the soldier.

140. When practising any one of the back positions, before exercising in pulling the trigger, the soldier should be practised in continuing the aim for nearly the full length of the period during which breathing can be retained. In this manner steadiness both of person and rifle can be quickly acquired.

General Remarks on the Preceding Drills.

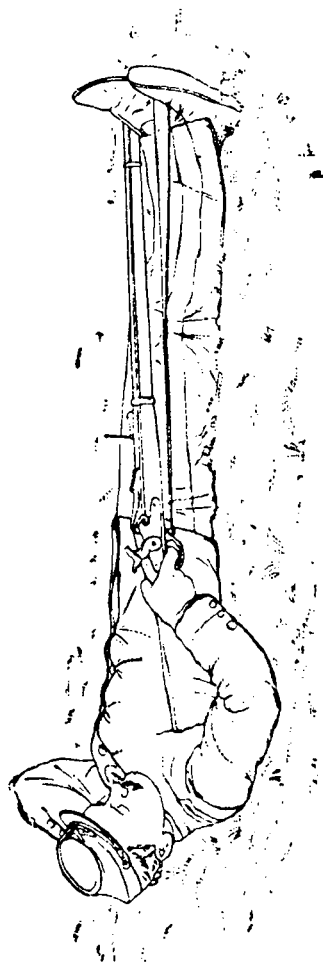
141. The importance of Sighting and Position and Aiming Drills cannot be too persistently impressed upon the soldier. If these exercises are carefully

PLATE XIII.



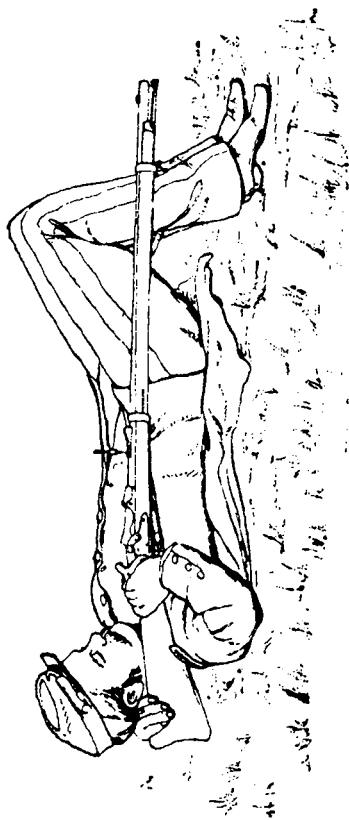
FIRING LYING DOWN

PLATE XIV.

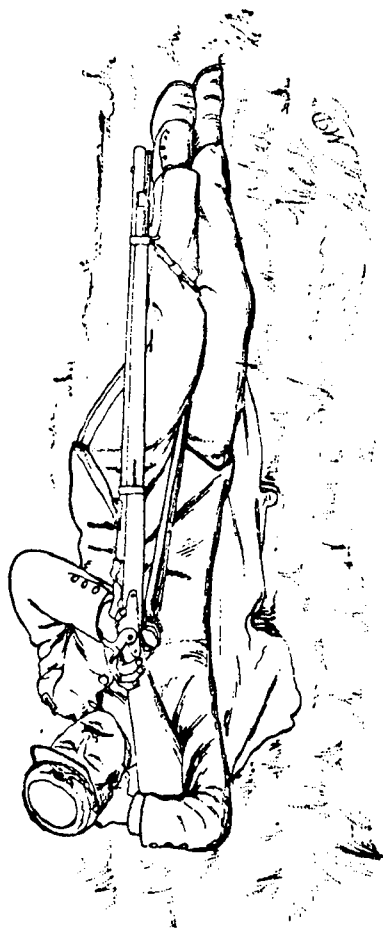


FIRING LYING DOWN.

PLATE XV.



FIRING LYING DOWN.



FIRING LYING DOWN—LAIDLEY POSITION.

practised, the soldier before firing a shot at a target will have learned to correctly aim his piece, to hold his rifle steadily, to pull the trigger properly, and to assume that variety of position best adapted to the particular conformation of his body. This knowledge cannot be successfully acquired upon the target ground; at that place the time that can be given to instruction is limited, and should be devoted to the higher branches of the subject; and even if the desired amount of attention could be given to each soldier, yet, from the circumstances of the firing, the determination of his errors cannot be readily made, and it is more than likely that the soldier will never discover the reasons for his failures, and will, therefore, be unable to properly correct them.

Under such conditions, the knowledge that he may have of the many other requisites for good marksmanship cannot be utilized to full advantage, and in fact can but in a limited degree compensate for the neglect of these first principles, and for the failure to lay, by assiduously practising them, the only firm foundation for future proficiency.

142. If in any of the preceding drills, the instructor observes a defect on the part of any soldier, he commands, *As you were*, at which the man resumes his former position and is then required to repeat the movement until the error is corrected.

143. Great advantage will be derived by practising these exercises at other than drill hours, the soldier when in barracks at odd times giving a few moments to the position and aiming drills, but being always careful to first select some definite object upon which to sight.

CHAPTER III.

GALLERY PRACTICE.

144. After the soldier has been thoroughly instructed in sighting and in position and aiming drills, he will be exercised in firing at a short range with reduced charges.

As the object of the practice is simply to continue in a different manner the instruction of the preceding exercises, the firing will be held both standing, kneeling, sitting, and lying down; and in order that the soldier may have experience in the appearance of the sight in its different positions, and practise in the consequent changes in the position of his head, when aiming, use will be made of the rear sight adjusted for the different ranges, up to 600 yards.

145. The cartridge employed for gallery practice and the methods to be followed and care necessary to be exercised in reloading and using it is explained in Appendix A. The service rifle is used for the firing, as the advantage of accustoming the soldier to its weight, balance, and trigger-pull much more than counterbalances any possible superiority resulting from the use of a special or gallery rifle.

146. A building 55 or 60 feet long should be selected for the gallery and should be so arranged that there will be a strong light upon the target. The light at the firing point, which need not be quite so bright as at the target, should, if possible, be from overhead, from the rear, or from both sides, as a window at either the right or left hand only will brighten one side of the front sight, leaving the other in shad-

ow, and inaccuracies in aiming will result. Windows between the firing point and the target are objectionable as giving cross light and possibly shadows. When a building cannot be especially devoted to the purpose, practice can be had in the company quarters, or if sufficiently light in cavalry stables; it should not be held in the barrack yard or piazza or other unsheltered place if a regular gallery can be obtained, as the main advantage of gallery practice—its excellence as an aiming drill—will be sacrificed if the firer, or any portion of the range, is exposed to influences which can cause a deviation of the bullet.

147. A target with other divisions than the bull's-eye is not, as in range practice, absolutely essential for this exercise; but the better to retain the interest of the men and to enable them to form some comparative estimate of the degree of proficiency that they at different times may attain in this form of aiming drill, the target employed should have several divisions.

148. As this practice is merely a form of aiming drill, and as the conditions which mainly determine the form and dimensions of the targets for range firing do not obtain in the gallery, no effort should be made to employ a target whose dimensions bear any particular proportion to those of the range targets, but the size of the bull's-eye and of the different divisions should be determined by the length of the gallery range.

For ranges of about 50 feet, the target will be 7 inches high and 6 inches wide, with a circular bull's-eye 1 inch in diameter and 2 other circular divisions 3 inches and 5 inches in diameter respectively.

If the gallery is 75 feet long these dimensions will

be increased one-half. If the gallery is 100 feet long, they will be doubled. A shot in the 'bull's-eye' will be scored 5. In the next ring, called the centre, 4. In the other ring, called the inner, 3; and a shot in the remainder of the target, called the outer, 2.

149. If it is found inconvenient to have a different size of target as the distance for firing is increased, the same target may be retained for all distances, the firing at the longer ranges being preferably held from the kneeling, sitting, or lying positions.

150. The form of bullet-stop depends upon the kind of targets employed. These may be either of paper or iron. With the former, the butt should be double, with a space of about 12 or 18 inches between the butts, the front one formed of 2-inch planks, and the second one of 2-inch planks, also, but faced with sheet-iron—pieces of condemned stoves or circular saws might answer; between the front and rear faces, a box should be placed on the floor to catch the balls after they strike the iron plate. If the sheet-iron cannot be obtained the space between the butts should be filled with sand, earth, or sawdust.

151. The paper target and this form of butt are objectionable, in that compared with the iron target the marking is slow, the target is rapidly cut to pieces by the bullets striking so closely together, and the divisions on it are quickly disfigured by the necessary pasters; several targets will therefore be required for a single company practice. The planks just back of the target are soon cut through and must be often replaced, and it is possible that balls fired with a somewhat diminished charge of powder may rebound the entire length of the gallery.

152. If an iron target is used, the wrought-iron plate should be about one-half inch thick, 30 inches long, and 20 inches wide, and should have shallow grooves cut on its surface marking the outline of the bull's-eye and the different divisions. The soldier's interest in the firing will be increased if the bull's-eye is entirely cut out, and a plate of metal placed behind the target, on which the bullet, when impinging will give a sound different from that caused by a shot striking any part of the remainder of the target.

The target plate should be screwed at the corners to a screen of two thicknesses of 2-inch plank ; ammunition boxes filled with earth will answer if the planks cannot be obtained. The iron plate will stop by far the greater number of bullets, the wild shots will bury in the wooden screen.

153. The spatter of the lead ball on the iron target is its single disadvantage, but in firing at a distance of 50 feet, with 4 grains of powder, the spatter is very slight, and most of the balls fall at the bottom of the target, seldom rebounding more than 5 or 10 feet.

The advantages of this target are its endurance and the quickness of marking and readiness with which shot marks can be erased without disfiguring the divisions on the target.

154. To prevent any possible danger to the marker from stray bullets or spattering lead, in permanent galleries where a large amount of practice is held, a shelter should be constructed which, that it may not darken the target, should be at that side furthest from the principal source of light. The face perpendicular

to the butt should meet it about 2 feet from the targets; need not be of a greater thickness than 1 inch, and should have a door 1 foot wide, and 3 feet long, through which the marker can erase the shot mark on a target placed at the proper height for firing either standing, kneeling, sitting, or lying down. The other face of the shelter, parallel to the butt, should be made of a double thickness of 2-inch plank. The marker should be provided with pots of black and white paint, and small brushes at the end of, and perpendicular to, rods about three feet long; these will enable him to erase the mark made by the bullet, without exposing any portion of his body outside the shelter. For the practice of a single company in the company barracks, this shelter will not generally be required; it will suffice for the marker to stand during the firing 4 or 5 yards to the front and to one side of the target, and to erase the shot marks after each score of 5 shots.

155. If a large iron plate can be obtained, a most excellent combination of butt and target can be made by using a plate of boiler iron of sufficient size to receive the impact of the wild shots, and so inclined as to deflect the bullets into a long, narrow box placed beneath it upon the floor.

156. At 10 feet or any other convenient distance in front of the butt a support should be constructed upon which may be placed a light target frame, over which is stretched canvas having a paper target pasted upon it. If the accommodations will permit, several of these target frames might be so placed as to allow the simultaneous practice of 4 or 5 men.

157. If firing is held at not more than 50 feet, the

soldier can easily distinguish the effect of his shot. Marking during a score will not then be necessary, and as each squad completes its 5 shots per man, the target frames can be replaced by others ready for firing, and the targets just used prepared for future practice.

158. This method of using paper targets will be found advantageous if sufficient width of gallery can be obtained, even if the iron butt cannot be procured. It can also be followed with one target frame, for the firing at one time of a single soldier.

159. The distance at which practice is held will, of course, be determined by the dimensions of the gallery; it should, however, not be less than 40, nor more than 100 feet; 50 feet should, if possible, be selected, because at this range the soldier can readily see, even before removing the rifle from his shoulder, where the bullets strike, and his errors in aiming are therefore at once made evident; and the small charge of powder which is best adapted for this distance imparts to the ball so low a velocity that a sensible interval of time is required for its passage through the barrel, during which the rifle must be held steadily, or inaccuracy of fire will result; the necessity of steadiness even after pulling the trigger is thus firmly impressed upon the firer.

160. As the powder issued to companies sometimes varies in strength, the proper charge for any particular length of gallery range should be determined by a commissioned officer, or one of the best marksmen firing several shots from the shoulder, with the muzzle of the rifle on the sand-bag rest. The charge should be so regulated that, with the leaf of the rear

sight at 100 yards, and aim taken with a half sight, at the lower edge of the bull's-eye, the centre of the bull will be struck.

With the powder generally issued, 4 grains will be found to be the proper charge for a gallery range of from 50 to 75 feet, and $4\frac{1}{2}$ grains for a range of 100 feet.

161. Before commencing practice the soldier should be instructed that as the temperature and light of the gallery are not subject to the changes found on the target range, but remain nearly constant, no change in the elevation due to that cause will be required during the firing; some slight changes will, however, be required in consequence of the fouling of the barrel.

As both the firer and the range are completely sheltered, no unsteadiness on the part of the soldier or deviation of the bullet can be caused by wind. All the external influences which on the target range may cause inaccurate firing are therefore absent, and gallery practice becoming but a form of position and aiming drill, the errors committed will be only those incident to the men themselves. The soldier should also be reminded of the directions given in the sighting and position and aiming drills, and he should particularly be cautioned always to take in aiming the same amount of front sight, and not to pull the trigger with a jerk but with a gradual pressure, endeavoring at the same time to hold the gun steadily on the target and to continue the aim (which the absence of recoil renders easy) until the shot has struck; the effect of his errors, if any, in aiming or holding, or a possible jerking of the trigger, will then be made evident.

162. For instruction in off-hand firing practice will be held standing, the sight being adjusted for 100 yards, and aim taken at the lower edge of the bull's-eye. The very slight change in the appearance of the rear sight notch when the open sight is used, or in the position of the soldier's head when either the open or aperture sight is employed, resulting from raising the sight to the 200 yards adjustment, does not render it necessary to supplement the preceding firing by any practice with the rear sight adjusted for the 200 yards range.

163. For instruction in firing kneeling and sitting down practice will be held with the sight adjusted for 300 yards, or a little above or a little below 300 yards, depending upon the individual peculiarities in sighting, the aim (with a gallery range of 50 feet) being taken at the lower edge of an artificial bull's-eye, whose centre is 5 inches below the centre of the bull's-eye of the target. With the present rear sight, the correction for a range of 300 yards, for the drift of a conical bullet fired with the service charge, being when the sight is set for this elevation still made automatically, though for gallery firing it is not required, a change to the right in the lateral position of the aiming bull's-eye will also be necessary; or the correction may be made by taking $\frac{1}{2}$ point of the wind-gauge to the right, thus neutralizing the drift allowance on the sight; if this is done the aiming bull's-eye should be retained directly below the bull's-eye of the target.

The bull's-eye for aiming should be $2\frac{1}{2}$ feet from the floor, and of the same size as the bull's-eye of the target; if, however, the gallery is badly lighted, or if from poor eyesight any of the men fail to see the aim-

ing bull's-eye distinctly, its size may be slightly increased.

If the gallery range is 75 feet the distance between the centre of the target and the centre of the aiming bull's-eye should be $6\frac{1}{2}$ inches.

If the gallery range is 100 feet the distance between the centres of the two bull's-eyes should be 8 inches.

164. For instruction in firing lying down practice will be held with the rear sight adjusted for 500 and 600 yards, or a little above or a little below these positions, depending upon individual peculiarities in sighting. The aiming bull's-eye should be 12 inches from the floor, and, for a gallery range of 50 feet, the bull's-eye of the target $10\frac{1}{2}$ inches higher when the sight is adjusted for 500 yards, and 12 inches higher when the sight is adjusted for 600 yards. If the gallery range is 75 feet, these distances should be 16 inches and $18\frac{1}{2}$ inches respectively. If the gallery range is 100 feet they should be 18 inches and 22 inches respectively. With the present sight for these elevations and lengths of gallery range, the aiming bull's-eye must be moved to the right, or the leaf moved a little less than $\frac{1}{2}$ point to the right for 500 yards, and a little more than $\frac{1}{2}$ point for 600 yards, as indicated in the preceding paragraph. If found necessary the size of the aiming bull's-eye should be increased as explained in the preceding paragraph.

165. The aiming bull's-eye should not be painted on the target plate; it will be found better to use one of the black target pasters, which are employed to erase shot marks in range firing; its position can then be

readily altered to adapt the target to any class of the preceding practice.

166. To prevent the possibility of the soldier aiming at the wrong bull's-eye when firing kneeling, sitting, and lying down, the bull's-eye of the target should not be painted black, but its outline only indicated as in the case of the "centre" and "inner" divisions of the target.

167. Gallery practice partaking principally of the nature of an aiming drill, it is desirable that all men be instructed in firing kneeling, sitting, and lying, as well as in the off-hand position, without regard to the relative proficiency they attain, and practice should be about equally divided between these methods; the men in all cases adopting, whether firing standing, kneeling, sitting, or lying down, the particular variety of that position which seems to be best adapted to their individual peculiarities.

168. Gallery practice will be conducted in scores of five shots, the number of such scores to be fired by any man at a single practice being determined by the company commander.

No reports of the results of the firing will be required, but a record of it should be kept in the company for the instruction and guidance of the soldier.

169. In order that the soldier's comparisons of his firing at different periods may possess any value, no change should be made in the dimensions of the target employed, but they should always conform to those prescribed in paragraph 148.

170. The attention of the men to pointing and aiming drills soon flags, while gallery practice arouses and retains their interest; it also awakens the spirit

of emulation in the soldier, without which any considerable degree of progress cannot be made. To the instructor it affords the best opportunity for correcting the positions and errors of the men; and if carefully conducted the soldier who afterward practises on the range with full charges will, as soon as he becomes accustomed to the recoil, find it a simple matter to make scores which before seemed for him impossible.

171. Matches in gallery firing between the men, particularly the recruits, and between teams of the same or different companies, should be promoted and encouraged. While increasing the interest of the men in their practice, they at the same time afford experience in the conditions of competitive firing.

172. If men at any time fail at any particular range when firing with full charges, and in the opinion of the instructor their failure can be ascribed to other causes than erroneous judgment of the light or wind, they should be brought back to the gallery, and by practice in the positions and with the sights as they had just been used on the range, their errors should be determined and corrected.

PRACTICE WITH BLANK CARTRIDGES.

173. After thorough instruction in the preliminary drills, the recruit, before practising with ball cartridges on the range, should fire a few rounds with blank cartridges to accustom him to the noise of the discharge, and to the force of the recoil.

174. The instructor should give to all the details of the soldier's position and to his manner of holding the piece the same careful supervision exacted in the pre-

liminary drills. He should be especially particular that the rifle is held firmly against the shoulder, and the man brought to understand that where this is done the recoil will be felt only as a pressure tending to turn the body, instead of as a blow so quickly given that the shoulder does not readily yield to its influence and is in consequence often slightly bruised.

PART II.

INDIVIDUAL RANGE PRACTICE.

175. This practice completes the instruction of the soldier in individual firing with service charges at targets at known distances.

It will be divided into the preliminary and additional practice, and into the regular or record practice (see paragraph 872). Only the results of the latter will be considered in determining the class to which the soldier belongs.

176. The object of all the instruction of which range firing merely forms one of the final steps, is to increase the soldier's accuracy of fire with the small arm as he will take it into action. It is therefore requisite that his practice should be conducted with the rifle or carbine exactly as it is issued by the supply department having charge of the fabrication of arms; except that the front sight protector of the rifle being arranged for removal may, if the soldier so desires, be removed before firing. The use in regular practice of additional appliances, such as temporary shades for the sights, detachable spirit-levels, orthoptic eye-pieces, etc., which practically would in the field never be applied to the rifle or used in aiming, would only make the soldier dependent upon conditions unlike those which would obtain in battle, and will not be used in regular practice. Detachable spirit-levels may, however, be sometimes advantageously employ-

ed in the position or aiming drills, and will be permitted if the soldier desires to use them in additional practice. In the regular practice the firing must also be held "in the open" and not from any sheds or shelters.

CHAPTER I.

GENERAL INSTRUCTIONS.

177. THE troops of each organization will use in their small arm practice, both at known distances and in skirmish and volley firing, the weapon with which they are armed. Infantry and Artillery (except the Light Batteries) will therefore practise with the rifle; Cavalry with the carbine, and, under the rules of Part VIII., with the revolver. Officers and enlisted men of the staff corps who may practise will use the rifle.

178. During the target season the regular practice will be held, until the prescribed course is completed, at least three times a week—preferably on consecutive days—by each troop, battery, and company; and at least once a week by each regimental non-commissioned staff and band, but where any of the staff and band have been previously instructed and have some knowledge of the use of the rifle or carbine, their firing may be omitted.

All officers and enlisted men included in these organizations will attend each regular practice unless prevented by guard duty, sickness, or confinement under guard.

179. Company musicians and cooks and men detailed as hospital attendants may, however, be ex-

cused from all but two regular practices, in each month.

The general commissioned and non-commissioned staff and regimental field and staff officers and soldiers detailed as school teachers will be encouraged but not required to attend practice.

180. The regular practice will always be held in the presence and under the supervision of a commissioned officer.

In case neither the regimental adjutant nor quartermaster attends the firing, some other officer will be detailed to conduct the regular practice of the regimental non-commissioned staff and band. Other non-commissioned staff that may fire will be attached to the band or to some company for practice.

181. While it is desirable that the soldier should be instructed in firing under varying conditions of weather, yet practice, particularly in the first weeks of the target season, should not be held on days when the conditions are so unfavorable as to prevent accurate shooting.

182. Such an hour of the day will generally be selected for the regular practice as, considering the direction of the range with reference to the sun, the prevailing wind, etc., seems most favorable. An hour, however, will be chosen when the men are not fatigued from the performance of labor or from drill, and when sufficient time can be obtained for the deliberate completion of the firing before they are required for other duty. If this is not practicable the practice will be continued at some other time and until all the men have fired.

183. The regular practice will be held in scores of

5 shots each. For all firing at ranges less than 500 yards no sighting shots will be permitted, and the score will commence with the first shot fired. For the regular practice at 500 yards or any longer range, two sighting shots will be permitted before commencing the first of a succession of scores, or when but one score is to be fired before that score, but not before the second or any following score of a number fired consecutively. If practice is discontinued and then resumed at that range after an interval, during which others have fired, a rest been taken, or practice held at other ranges, two sighting shots will be allowed, as when firing was first commenced. If practice is continued at a different range, but one for which sighting shots are authorized, any previous firing at other ranges will not debar the soldier from taking advantage of the usual sighting shots.

184. While sighting shots are authorized in certain cases, yet the privilege is one readily abused. The soldier therefore will always be required to state before commencing his first score in practice at the mid and long ranges, whether he intends his first shot to be a sighting or a scoring shot; after this selection is made the result of the shot must *under no circumstances* be permitted to change the soldier's decision. If no selection is announced, it will be deemed that sighting shots have been taken.

185. If one sighting shot is fired the second must also be fired, and the score commenced with the third shot. More than two sighting shots will never be permitted. Sighting shots will only be permitted in the regular company practice, never in matches or competitions, for in these latter the comparative ability of

the contestants to accurately estimate the sight adjustments required is one of the elements of the competition.

186. After a score has been once begun in practice at any range, it must not, in consequence of poor shots, be discontinued and a new score commenced, but must always be first completed. If a score is interrupted by an accident to the target, a sudden storm, or other causes beyond the control of the company commander, it will be completed at the soldier's next practice, if not practicable to finish it the same day. These concluding shots may be preceded by sighting shots, but only under the restrictions of paragraphs 183 and 184.

187. While it is required that practice shall be in scores of 5 shots each, it is not intended that only one such score should be fired by the soldier. Whenever the time will permit he should, especially if his successive shots indicate improvement, or promise it for a succeeding score, be encouraged to fire several scores, and be allowed to continue the practice if he is firing accurately, up to the limit fixed for his season's practice.

188. If, when first practising, on any one day, the entire number of scores which may constitute the regular practice are not fired, the practice may be continued at some other hour under the usual supervision; no more scores, however, being fired at each range than may be necessary to complete the number prescribed for the season's practice.

189. Shots fired by an officer for the purpose of instructing his men will be considered as additional practice and will therefore not be included in the

number prescribed for his season's course, or the results of such firing in the officer's classification.

190. The officer in command of the firing party, besides affording his men such instruction as they may require, will be responsible that those waiting their turn to fire preserve order, and that all observe the general regulations of the range, and take such precautions as may be necessary to guard against accident.

191. The men will be called to the firing point in pairs, and that they may acquire the habit of carefully estimating for themselves the varying amount of elevation and wind allowance required, they will, before firing, inform the instructor how they consider the sights should be adjusted.

Whenever these adjustments differ materially from those generally adopted, they will state to the instructor the reasons which determined their selection. In all cases, if the instructor deem their estimates erroneous, he will direct that they be corrected, explaining to each soldier the nature of his errors.

The men of the pair will then assume the proper position for firing, depending upon the distance at which practice is being held, and will, without further command, load and fire alternately until a score of five shots is completed.

192. As each shot is fired the soldier will carefully notice the exact point at which the rifle was aimed, and will announce, before the shot is signalled, where he believes it to have struck. If he correctly calls the shot, it is probable that his sights were properly adjusted and no changes, except those in the elevation, which may be necessitated by the heating and fouling

of the barrel, will be required. If, however, the soldier calls the shot incorrectly, he should determine what changes in the rear sight are required, and, with the approval of the instructor, make the proper corrections.

193. If the men find it difficult to call the estimated location of their hit, a diagram of the target, drawn to a convenient scale, should be provided, on which the soldier can designate the point where he thinks his shot struck. By using two of these diagrams, one for each man of the pair firing, and pins with different colored heads, this method can be advantageously extended to graphically recording the estimated and true position of each shot of the score, thus exhibiting to the soldier, in the plainest manner, the nature of his errors.

194. Each soldier should endeavor to aim and fire with deliberation; if, when aiming, he feels unsteady and not confident of his shot, he should, without firing, lower his rifle to the position of ready, and only resume the aim after a moment's rest.

195. The instructor will watch attentively the position of each soldier; he will, however, be careful not to check a man for any error when he is aiming, as it would probably have the effect of rendering him nervous and unsteady; but after the soldier has fired will inform him of his errors, and caution him how to avoid them when firing the next shot.

196. While each pair is firing, the following pair will be designated, and will hold themselves in readiness to take promptly, when directed, their places at the firing point. As each soldier completes his practice, he may be either directed to remain upon the

firing ground for practice at other ranges, or be excused from further attendance.

197. Soldiers who in their regular practice have exhibited such proficiency that it is likely they would be considered when the selection is made for the representative of the company in the year's department competition, will, in the discretion of the company commander, be encouraged by additional practice to still further perfect themselves for such firing.

198. To still further encourage the men, such special indulgences as the post or company commanders may deem practicable should be given to the best shots or to those who show the most marked improvement.

INSTRUCTIONS FOR ADVANCING THE SOLDIER.

199. Before any practice on the range is commenced, it is most essential that the soldier, by careful attention to the sighting and position and aiming drills, and by gallery practice, should have become thoroughly at ease in the standing, kneeling, sitting, and lying positions and should have discovered and mastered the difficulties of steady holding and accurate aiming in each of these positions. Several months of this instruction will be required for the recruit, and at least an entire month for the soldier who in a previous year's firing exhibited only a moderate degree of proficiency. As the lack of continuous practice may have somewhat impaired the proficiency of even the expert shot, several weeks of the preliminary drills, especially that part covered by the gallery practice, will be found decidedly advantageous even in some cases for the sharpshooter or marksman. As, how-

ever, with *some* expert shots, gallery practice appears to injure rather than improve their subsequent range firing, it should not be required for the sharpshooters, but only conducted for them when found to be beneficial. If for the majority of the company this instruction has been carefully conducted, a great step has been taken in the soldier's education as a rifle shot, and he is properly prepared for range firing with the attendant recoil and for the study of the physical phenomena which affect the course of the bullet.

200. If, however, these rudiments of the subject have been neglected, a great amount of practice will be required at the shorter ranges, 200, 100, and even at 50 yards, before the soldier is enabled to ascertain (if he ever does) the nature of the errors he generally commits, and before he succeeds in eradicating them. As a result, much of the practice season will be lost and considerable ammunition will be expended without any increase in the soldier's accuracy of fire, and therefore, without much increasing his possible efficiency in battle.

201. Although the men may have been properly grounded, the change of conditions, from the gallery to the range, will generally impair the success of the earlier firings, and will, therefore, make it advisable whenever resuming range firing at the commencement of the practice season, to begin at the shorter ranges, and only as the men exhibit proficiency, or at that range complete the scores prescribed for their season's practice, advance them to the longer distances. This advance should not be hastily made, for many of the difficulties of range firing increase as the distances of the soldier from the target become greater.

202. In determining the proper method of conducting the further education of the soldier, the influence of his interest in his work (without which but little can be accomplished), of his ambition to attain a higher class in marksmanship and of the natural emulation between the men, should not be neglected ; for these are in reality the most potent factors, and by utilizing them as far as possible very great results can be accomplished and a high degree of efficiency attained.

203. Individual range practice will therefore be commenced at each range, each season, with preliminary, and also if desired with additional firing, to an extent depending upon the number of seasons in which the soldier has previously received instruction and upon the proficiency that he has exhibited.

PRELIMINARY AND ADDITIONAL PRACTICE.

204. By preliminary practice is understood the prescribed firing which precedes the record practice at the different ranges. Additional practice is firing supplementary to the preliminary practice and preceding the record or regular practice at any range ; or it is such further firing as may be held at any range after the record firing at that range is completed.

205. Preliminary and additional practice will not necessarily be held in scores of five shots, but in the manner and to the extent, up to the prescribed limit, that the company commander may decide ; provided that in all cases the full amount of preliminary firing at any range is completed before the record or regular practice at that range is commenced.

206. Preliminary firing will always be held under the same supervision and with the same precautions taken to insure fair and accurate marking and scoring as obtain in the regular practice.

207. For additional practice these usual supervisions may be relaxed, the men allowed to practise at the hours that may be selected and to fire such a number of shots as the allowance of ammunition will warrant. No record other than that which the soldier firing may desire for his individual guidance should be kept of this practice.

208. In known distance firing no soldier will be permitted any preliminary or additional firing at a particular range on the day on which his regular practice is subsequently to be held at that same range, as it is not intended that he should utilize either his preliminary or additional practice as sighting shots.

209. As a period of enforced rest from range firing will, to some extent, impair the proficiency of the soldier, the expert shot, who is desirous of representing his company in the annual competitions, will find it of great advantage to continue his practice to a moderate extent throughout the entire target year, taking advantage, for this purpose, of the most favorable days. Any scores made in this firing, out of the regular practice season, will, however, not be considered in determining the soldier's classification.

210. The range firing for recruits, including in that class all those enlisted men who have not had the benefit of the course of instruction in any previous season, will be commenced by firing fifteen preliminary shots at 100 yards, after which they will be advanced to 200 yards unless the company commander

deems additional practice necessary at the shorter range. This additional practice, if held, will not exceed fifteen shots (see paragraph 872).

211. The recruit will fire fifteen shots in preliminary practice, and may also fire such a number in additional practice, not exceeding fifteen, as the company commander may determine at each of the ranges 200, 300, 500 and 600 yards, before commencing his record or regular practice at those ranges.

212. In the second and all following seasons, the soldier will fire in preliminary practice five shots at 200 yards and ten shots at each of the ranges 300, 500 and 600 yards before commencing at those distances his record or regular practice. If, as hereafter provided, his regular practice is extended to 800 yards it will be preceded by ten shots preliminary firing at that range. But in the case of those who in previous seasons have shown themselves to be expert shots, this preliminary practice, or any portion of it, may be omitted.

213. In the second and following seasons any additional practice held after the prescribed preliminary, and before the regular practice will not exceed ten shots at each range.

214. The preliminary firing may, in the discretion of the company commander, be completed for all the ranges before commencing any of the course of regular practice, or it may be followed at one or more ranges by the record practice for those ranges before completing the entire preliminary firing, provided always, that at any particular range the preliminary firing is completed before any record practice is there commenced.

RECORD OR REGULAR PRACTICE.

215. From this firing the general proficiency of the soldier will be judged and it will be considered in determining his classification. It will always be held under the supervision of a commissioned officer, and every possible precaution taken to insure fair and accurate marking and scoring.

216. As soon as the soldier completes his prescribed preliminary and discretionary additional practice at any range, his record practice at that range may be commenced, or it may be delayed while his preliminary practice is prosecuted at one or more different ranges. But whenever his regular practice is commenced at any particular range he will be permitted no other firing at that distance until it is completed and all shots there fired up to the prescribed number will be included in the record, and in the determination of his classification.

217. The record or regular practice for the recruit will comprise 40 shots at each of the ranges 200, 300, 500 and 600 yards (see paragraph 872).

218. The record or regular practice, at known distances, for soldiers in their next, the second, season's course will comprise 40 shots at each of the ranges 200, 300, 500 and 600 yards.

If in this practice firing, with the rifle, any soldier attains a total score of 640, or firing with the carbine, a total score of 590, this regular practice will be extended to 800 yards, 40 shots being fired at that distance.

219. The regular practice, at known distances, for soldiers who have completed the second season's

course will in subsequent seasons comprise 20 shots at each of the ranges 200, 300, 500 and 600 yards.

If in this practice firing, with the rifle, any soldier attains a total score of 320, or, firing with the carbine, a total score of 295, his regular practice will be extended to 800 yards, 20 shots being fired at that distance.

220. While it is intended that company commanders shall exercise their discretion in conducting the details of this course, it will yet in the general case be found better to complete each man's entire preliminary instruction before commencing his record practice.

In this case his firing can be held at any range, and the particular conditions of weather, which on the day assigned for practice may be more favorable for firing at the short than at the longer distances, or the reverse, can then be taken advantage of and more satisfactory results thereby obtained.

CHAPTER II.

DETAILS OF INDIVIDUAL PRACTICE.

221. THE graduations on the rear sights of the rifle and carbine are determined from actual firing at the National Armory under average conditions of weather. The elevations thus marked for different distances will not be found to answer, without correction, when firing is held at other places, but will vary with the height of the range above sea level; and on the same range with variations in atmospheric conditions, the peculiarities of shooting of different guns and the dif-

ferent ways of sighting, holding and pulling trigger on the part of the soldier.

222. After the soldier has determined by experience the elevation he requires for different distances at any particular military post, and for any fixed conditions of the weather, the tables in Part VI., Chapter III., will enable him to make the proper adjustment of the sight for any other circumstances of firing.

223. The sights upon military firearms not permitting any very delicate adjustment, and it being impossible to anticipate the particular errors in each shot, which may occur in consequence of the variations in the rifle and ammunition, care has been exercised in the following remarks upon practice at the different ranges, to specify in only approximate terms the effect of changes in the sight upon the position of a hit, or the influence of the atmospheric conditions upon the flight of the bullet. Such corrections as are specified have therefore been given, as far as possible, in whole numbers, or in simple parts of the unit of measure. It is therefore believed that after a little practice they can be readily applied by any soldier.

224. The width of the bull's-eye and one-half of its height have been employed as the units of measure in estimating what changes it is desired to make in the position of a hit; for whenever a hit is signalled the eye can readily apply this unit, while it is not as simple to compute the error in feet or inches, the usual units of linear measure.

Short Range Practice.

225. *One Hundred Yards.*—Target A will be used for practice at this range. No use will be made of the

gun-sling, which will be strapped tightly to the barrel or only sufficiently loosened to permit the free passage of the hand between it and the stock. No rest for the rifle or carbine will be allowed, or for any part of the body, except that, as prescribed in the position drills, the left elbow may be brought against the breast. With these limitations the standing position which the soldier can take with the greatest ease and steadiness should be adopted.

226. At this range the wind causes only a slight deviation of the bullet, an allowance of 1 point on the wind-gauge of the rifle being sufficient to compensate for a wind acting at right angles to the plane of fire with a velocity of about 18 miles an hour.

227. *Two Hundred Yards*—Target A will be used for practice at this range, and the position, with its variations and restrictions, which was prescribed for practice at 100 yards will also be employed.

228. At this range the drift of the rifle bullet is 3 inches, for which the sight, when adjusted for the necessary elevation, makes an automatic correction of nearly $\frac{1}{2}$ point to the left.

The drift for the carbine is $1\frac{1}{2}$ inches, for which a correction of not quite $\frac{1}{2}$ point to the left is automatically made.

229. At this range 1 point of the wind-gauge of the respective arms compensates for a wind acting at right angles to the plane of fire, with a velocity of about 8 miles an hour for rifle firing, and about 10 miles an hour for carbine firing.

230. To change the horizontal position of the shot to the right or left a distance equal to the width of the bull's-eye, the wind-gauge should be moved in the

corresponding direction about $\frac{3}{4}$ of a point for the rifle, and a little less than $\frac{1}{4}$ point for the carbine. To make a change equal to $\frac{1}{4}$ of the width of the target, the wind-gauge on the rifle should be moved 3 points, that on the carbine about 2 points.

231. In making changes in the elevation the soldier should be governed by the fact that at this range an increase of about 17 yards in the elevation for the rifle and 12 yards for the carbine will raise the shot on the target about 5 inches, or $\frac{1}{2}$ the length of the bull's-eye.

232. *Three Hundred Yards.*—Target A will be used for this practice, which will be held kneeling or sitting down. In determining the particular form of these positions, all possible freedom will be permitted the soldier; for, while it is desirable that practice in some form of either the kneeling or sitting positions, or both, be made imperative, yet the soldier should be encouraged to adopt that variety of either of these positions which gives him the greatest steadiness.

The gun-sling will be arranged as required in paragraph 225.

233. At this range the drift and corresponding correction is for the rifle about 5 inches, equal to a little over $\frac{1}{4}$ point; and for the carbine $2\frac{1}{2}$ inches, corresponding to about $\frac{1}{6}$ point. These corrections, as at 200 yards, being automatically made in adjusting the elevation.

234. At this range one point of the wind-gauge of the respective arms compensates for a wind acting at right angles to the plane of fire, with a velocity of about 7 miles an hour for rifle firing, and about 9 miles an hour for carbine firing.

Comparing this with the effect of the wind at 200 yards, it will be noticed that when continuing, at 300 yards, practice previously held in the same wind at 200 yards, it will only be necessary to increase by about $12\frac{1}{2}$ per cent. ($\frac{1}{8}$) the allowance on the wind-gauge which was found necessary at the former range.

235. When firing at 300 yards, to move the shot horizontally a distance equal to the width of the bull's-eye, a change of about $\frac{1}{4}$ point on the wind-gauge will be required for the rifle, and a little less than $\frac{1}{4}$ point for the carbine. It will be moved $\frac{1}{4}$ of the width of the target by a change of a little more than 2 points for the rifle and of $1\frac{1}{8}$ point for the carbine.

236. For changes in the vertical position of the hit, an alteration of about 10 yards in the elevation for the rifle, and about 7 yards for the carbine, will be required to raise or lower the shot a distance equal to half the length of the bull's-eye.

Mid Range Practice.

237. *Four Hundred Yards.*—Whenever practice is held at this range, the firing will be at target B, and in the position prescribed for 300 yards. It will, however, generally be better to omit firing at this distance and to pass from the 300 directly to the 500 yards range. This is advisable, as all the instruction in firing, kneeling, or sitting down which is required can be obtained at 300 yards, and as the increase of the range from 300 to 400 yards does not alter very materially the effect of the atmospheric conditions upon the soldier's ability to do accurate firing; and as, moreover, to make the practice of any considerable value, it would require the introduction of a target, with

dimensions between those of the A and B targets, thereby complicating the practice to a degree for which the consequent advantages do not offer a sufficient compensation.

238. *Five and Six Hundred Yards.*—Practice will be held at target B, the soldier firing lying down; at 500 yards the firing will be from the prone position, at 600 yards any position lying down, either prone or on the side or back, will be permitted, except that no form of rest for the person or for the rifle other than may be afforded by the body will be allowed.

The gun-sling may be used in any manner in connection with the body, but with no extraneous objects, in steadying the rifle or absorbing the recoil.

The shortness of the carbine barrel will generally with that arm make the prone position imperative.

239. At 500 yards the drift and corresponding correction is for the rifle about $11\frac{1}{2}$ inches, equal to nearly $\frac{1}{2}$ point; and for the carbine about $9\frac{1}{2}$ inches, corresponding to nearly $\frac{1}{2}$ point. These corrections, as at shorter ranges, being automatically made in adjusting the elevation.

240. At this range one point of the wind-gauge of the respective arms compensates for a wind acting at right angles to the plane of fire, with a velocity of about 5 miles an hour for the rifle, and about $6\frac{1}{2}$ miles for the carbine.

Comparing this with the effect of the wind at 200 and 300 yards, it will be seen that if the wind remains the same, the 200 yards allowances for both the rifle and carbine must be increased a little more than one-half, and those found to be correct for 300 yards a little less than one-half, when afterward firing at 500 yards.

241. The effect of a rear or head wind is not very marked when firing the rifle at this distance; a wind of 1 mile an hour, blowing in the plane of fire, only changing the range a little less than $\frac{1}{4}$ of a yard. A 10-mile wind would then require a decrease of about 7 yards in the elevation if it was from the rear, or an increase of that amount if from the front.

242. For a change in the horizontal position of a shot a distance equal to the width of the bull's-eye, the wind-gauge must be moved about $\frac{2}{3}$ of a point for the rifle, and about $\frac{1}{3}$ of a point for the carbine. For a change equal to $\frac{1}{4}$ of the width of the target these allowances are 2 points, and a little less than 1 point, respectively.

243. The vertical position of the hit is changed a distance equal to half the height of the bull's-eye by a change of about 12 yards in the elevation for the rifle and 7 yards for the carbine. Changes of 35 and 25 yards respectively will alter its position by a distance of about 3 feet, or half the height of the target.

244. At 600 yards the drift and corresponding correction is for the rifle about 16 inches, equal to slightly more than $\frac{1}{4}$ point; and for the carbine 15 $\frac{1}{2}$ inches, corresponding to nearly $\frac{1}{4}$ point. These corrections, as at shorter ranges, being made automatically with considerable accuracy, in adjusting the elevation.

245. For the rifle, 1 point of the wind-gauge compensates for a direct cross wind of about 4 $\frac{1}{2}$ miles an hour; for the carbine, for one of about 6 miles an hour.

The proper allowance at shorter ranges should therefore for firing in a similar wind at 600 yards be increased as follows: the 200 yards allowance about

$\frac{3}{4}$, the 300 yards allowance about $\frac{1}{2}$, and the 500 yards allowance about $\frac{1}{6}$.

246. The effect of a wind blowing in the plane of fire is still slight at this distance, although greater than at 500 yards. The required correction at 600 yards for rifle firing being about $\frac{2}{15}$ of a yard for each mile of rear or head wind.

247. The horizontal position of a hit will be moved a distance equal to the width of the bull's-eye by a change in the wind-gauge allowance of a little more than $\frac{1}{2}$ point for the rifle and $\frac{1}{4}$ point for the carbine.

248. The position of a hit will be moved vertically half the height of the bull's-eye by a change of about 8 yards in the elevation for the rifle, and about 6 yards for the carbine; for a distance of about half the height of the target these corrections are, approximately, 25 yards and 20 yards, respectively.

249. The present rear sight permits a movement of the wind-gauge more than sufficient to compensate for any wind in which practice would be contemplated; when it is used any desired correction can, therefore, be made. Aim can then be taken directly at the point it is desired to hit without the device of aiming off the target, necessary when a sight is used having a more limited wind-gauge, like for instance the sight formerly in service.

250. The corrections for a cross-wind being made independently of those for drift, they will be the same for any particular velocity of wind, whether its direction is from the right or left of the plane of fire. But the corrections for a head or rear wind also involve slight corrections affecting the lateral position of a hit, which, when the alterations for elevation are

considerable, cannot be neglected as they might be sufficient to account for variations not otherwise understood.

251. For the rifle, fired at 600 yards, a movement of one point of the wind-gauge affects the position of a hit by about half the width of the target. This is a unit easily remembered and will be found convenient in practice. For the carbine, at this range, one point would move a hit about $\frac{1}{3}$ of the width of the target.

Long Range Practice.

252. Long range individual firing will as a rule be confined to the record distance, 800 yards, though the best shots among those armed with the rifle will occasionally be given some little additional practice at 1,000 yards. Practice will be held at target C, the position with its variations and restrictions which was prescribed for the practice at 600 yards being taken.

253. In the practice at these long ranges the principal difficulty lies in the necessity for greater refinement in the estimate of the elevations required—changes in the temperature, in the force and direction of the wind, in the light, and in the manner of aiming, all producing marked effects upon the range. It will therefore be necessary to study attentively all these factors and to aim with even greater care than at the shorter ranges.

254. The changes in the range produced by variations in the temperature, and by a wind blowing in the plane of fire, are given in Part VI., Chapter III.

It will be noticed from a comparison of these changes with those experienced at 600 yards, that at

800 yards they are more than 50 per cent. greater and at 1,000 yards their value has been more than doubled. Each mile of the component of the wind in the plane of fire increases the range if it is a rear wind, or diminishes it, if a head wind, nearly $1\frac{1}{2}$ yards for the 800 yards range and about 2 yards for the 1,000 yards range.

255. The position of a hit will be changed vertically a distance equal to half the height of the bull's-eye by a change, at 800 yards, of about 10 yards, and at 1,000 yards of about 7 yards, in the elevation. A shot will be raised or lowered a distance equal to $\frac{1}{4}$ of the height of the target by a correction in the elevation of about 25 yards for the 800 yards range, and of about 17 yards for the 1,000 yards range.

256. At these ranges the drift of the rifle-bullet is $28\frac{1}{2}$ inches for 800 yards, and 43 inches for 1,000 yards, for which the sight when adjusted for the necessary elevations makes automatic corrections of about $\frac{1}{8}$ and $\frac{1}{4}$ of a point respectively.

257. One point of the wind-gauge compensates for a direct cross wind of about $3\frac{1}{2}$ and $2\frac{1}{2}$ miles an hour at these ranges respectively; at 1,000 yards the same wind then produces about twice the deflection, as measured by the wind-gauge on the sight, that it does at 600 yards.

258. For a change in the horizontal position of the hit a distance equal to the width of the bull's-eye, the wind-gauge must be moved $\frac{1}{4}$ point when firing at 800 yards, and $\frac{1}{2}$ point if firing at 1,000 yards; at these ranges to produce a change equal to $\frac{1}{4}$ of the width of the target, $2\frac{1}{2}$ or 2 points respectively will be required.

259. With the present sight all necessary wind-gauge corrections can be made, and by its adjustments any desired change in the lateral position of a hit can be effected. Cases may however arise when it may be convenient, without altering the sight, to select a different point of aim, even to the extent of holding off the target. Whenever this method is resorted to, it will be found advisable to employ as a unit of measure in estimating the distance of the point of aim from the side of the target, either the full width or the half width of the target, as seems most convenient. When aiming in this manner there is great danger of inaccuracy in the elevation; this is best avoided whenever a half sight is employed by first taking aim as usual at the lower edge of the bull's-eye and then slowly changing the direction of the rifle to the right or left, looking along the sights to see that no alteration occurs in the amount of front sight visible, and also noticing that the horizontal line of open sight (which in these cases should always be used) remains apparently tangent to the lower line of the bull's-eye. This method of aiming should not be adopted unless a considerable change in the sight is necessary and it is desired to deliver the shot quickly without delaying to alter the wind-gauge.

CHAPTER III.

SUGGESTIONS TO RIFLEMEN.

260. GREAT care should always be taken by the soldier, both in loading and in handling a loaded rifle, that all possibility of accident may be avoided. If

the company has been marched to the target ground, before breaking ranks the commands "*Open CHAMBER*" and "*Close CHAMBER*" should be given; if the company is not in ranks each soldier should execute these motions independently. The same precautions should be observed after passing from one firing point to another.

261. As the firing pin may sometimes clog from rust or dust, or be bound by too tightly turning down the firing pin screw, it should be occasionally examined.

Reloaded shells often fit the chamber tightly and are not easily inserted; some little force may therefore be required to close the breech-block; this should be exerted slowly and by pressure rather than by a blow.

262. The rifle should never be loaded except at the firing point, and then only when it is the soldier's turn to fire; in loading, the muzzle should be directed toward the ground or targets. The piece should not be brought to the full cock, especially when firing lying, until the position for firing has been assumed. If the firing is delayed either by the display at the targets of the danger signal, or from other causes, the chamber should be opened, and if the delay is at all prolonged the cartridge should be withdrawn. Under no circumstances should the soldier leave the firing point with his rifle loaded, or permit it when loaded to pass out of his hands.

263. The degree of success attained in rifle firing depends greatly upon the extent and thoroughness of the preliminary drills. This is especially true for firing from the standing and kneeling positions, from

which, if the preliminary drills have been assiduously followed and carefully studied, excellent results can be expected at even the earlier practices with full charges on the target ground. These drills, besides teaching the best method of holding the rifle, of aiming and of pulling trigger, which are the elements constituting the very alphabet of rifle firing, also afford the soldier the opportunity for selecting the variety of position for the different ranges which, while sound in theory, is best adapted to his individual peculiarities.

264. After this selection has once been made it should not be abandoned simply because the soldier sees better scores made by others from different positions, but should be adhered to long enough to give it a thorough trial. Nothing injures firing, especially at the longer ranges, more than perpetual changes of position; each change affects at least the appearance of the sights or the touch upon the trigger; it may also alter the relative tension or relaxation of the muscles, and until the soldier has had the time and practice required for a knowledge of these altered conditions and their effects, his average shooting will usually be poor.

If frequent changes of position are detrimental, those made while firing a single score are still more so, and under such circumstances the soldier should not be surprised by the poorness of his record.

265. The remarks with reference to the various positions and the details of position and aiming drills, given in the chapter on that subject, are commended to the careful consideration of the soldier. Some men find it difficult to obtain a comfortable kneeling

position ; in such cases it will be advisable after firing each shot either to rise or to sit on the ground for a moment's rest before again firing.

266. Before going to the target ground the rifle should be carefully cleaned and the front sight cover adjusted, or if these sight covers have not been furnished, the front sight should be blackened. These precautions are especially necessary on a bright day, when if the sun is in any position except either directly in front or behind the soldier, the light falling more on one side of the sights than on the other, the eye will catch that side rather than the centre of the sights and inaccuracies in aiming will result. The sights may be blackened with the smoke from burning camphor gum, rubber, a wax match, or even an ordinary lucifer match. The sights should be free from oil, clean and dry, but as the soot broadens the front sight, no more should be permitted to collect than is required to give a smooth, uniform color.

267. In cleaning the rifle, a wet flannel rag should be first passed through the bore ; this should be only sufficiently moistened to soften and remove the greater portion of the residuum of the powder ; if an excess of water is employed the difficulty of wiping the piece dry is enhanced, and the probability of rusting the extractor or the head of the breech screw is much increased. Several oiled flannel or canton-flannel rags should next be used ; these should fit the bore closely and be run up and down several times to remove any lead ; after the bore is clean it should be wiped out with a dry rag to remove any excess of oil.

The cosmoline oil supplied with the box of cleaning

materials is one of the best for the purpose ; sperm and sewing machine oil are also good. Olive oil often gums and should not be used.

A wooden cleaning-rod should always be employed, as the iron ramrod may scratch the bore and injure the rifling.

The rag or cloth used in cleaning should not be left in the barrel, for if present when the piece is fired it may produce a swollen barrel ; the sand or dust which might collect around it and perhaps remain after it was withdrawn might also tend to produce the same result.

268. Even if the piece has been put away clean after previous practice, a slightly oiled and then a dry rag should be passed through the bore just before firing ; this insures the barrel being always in the same condition for the first shot and eliminates the variations caused by differently cleaned or oiled bores when the effect of the weather upon the amount of heating and fouling is considered in making the corrections in elevation for the following shot.

269. When practice is concluded the piece should be at once cleaned, before the fouling has had time to harden.

270. These remarks upon cleaning the rifle are by no means concurred in by all good shots ; many will never clean during the whole day's firing, and prefer to commence a score with a fouled barrel, thus eliminating one element which otherwise requires changes in the elevation for succeeding shots. If it was only the fouling which required these changes, possibly there would be little gained by cleaning ; but the heating of the barrel and perhaps (the cause is not

fully determined) the expanding of the bands, which therefore permit an increased downward spring of the muzzle at the moment of discharge, cause the bullet to drop on the second or third shots, and still make some changes necessary in the elevation. The advocates of non-cleaning also claim that the residuum of the powder, coating the surface of the bore, prevents or greatly reduces the leading of the barrel; while this may be so, it is still true that a gun which has been some time in service and has been frequently fired, will not lead, independent of the particular method of cleaning or non-cleaning which may have been followed.

271. Whenever practice is renewed on the same day after an interval of a few minutes or not more than one or two hours (as for the firing in Department competitions) it will be found most advantageous to commence at the first range with a clean gun, and then not to clean again during the day's practice; this will greatly reduce the amount of the corrections in elevation required before firing the second or third shots.

272. The advice is hereafter given to blow or breathe through the barrel after each shot; this is especially advantageous if the plan of non-cleaning is followed. In addition to this precaution, if the gun has been allowed to cool and the residuum to harden after former firing, the barrel should be blown into repeatedly before resuming firing, in order to moisten and soften the fouling; the use of the Brown breathing-tube, which consists of an empty cartridge shell of the service calibre, into the opened head of which is secured a rubber tube with a mouth-piece at the other

end, is particularly advantageous, as it conducts the breath directly upon the accumulation of fouling in front of the chamber.

273. Shortly before the soldier is called to the firing point he should enter in his target record book the date, time, and distance of practice, and also the condition of the weather, light, and wind. He should then examine his record to see if he has previously fired under conditions similar to those then existing; if such a day is found he should deduce, by comparing the recorded elevations and allowances with the resulting scores then made, as shown on the diagram, the adjustments of the sight deemed most suitable.

274. If the record of former firing has not been kept with the proper care, or if the atmospheric conditions are unlike any previously experienced, the soldier will be compelled to reason out the theoretical adjustment required. For the lateral adjustment of the sight a knowledge is requisite of the force or velocity and direction of the wind, and of the value of one point on the wind-gauge in overcoming the deviation of the bullet at different ranges. This value for a wind acting at right angles to the plane of fire is given in the previous chapter, and also in a slightly different form in paragraph 722. The latter, while more conveniently applied, does not, however, when the velocity of the wind is considerable, express the proper wind-gauge corrections with quite as close a degree of approximation.

275. The manner of observing and expressing the direction of the wind is explained in paragraph 715; and of the force or the velocity of the wind, and the value of its deviating component, in paragraph 718.

276. The force of the deviating component can be directly obtained by observing the passage of the smoke across the line of fire. To this end an observer should be placed to leeward of a person firing, at a distance of 88 feet ($\frac{1}{8}$ of a mile) from the line of fire. Looking in a direction parallel to the line of fire, he notes the number of seconds which elapse from the firing to the passage of the first portions of the smoke across his line of sight. Dividing 60 by the number of seconds observed, the quotient will be the velocity per hour, in miles, of the deviating component. When the smoke is quickly dispersed, or the wind at but a slight angle with the line of fire, 44 feet or 22 feet had best be taken and the number of seconds observed multiplied by 2 or 4, and the product used as a divisor as in the case of 88 feet.

277. With the effective strength of the wind thus determined, the number of points or fraction of a single point required to compensate for any direction and velocity of the wind can be obtained. To this allowance should be added if the wind is with the drift, that is blowing from the left, and should be subtracted if the wind is from the right, the proper correction for the drift at different ranges as given in the preceding chapter. With the present rear sight these corrections for drift should be disregarded and the wind allowance applied directly.

278. For instance: firing is to be commenced, with the rifle, at 600 yards; the wind is blowing from half-past one o'clock with an estimated velocity of about 12 miles an hour; the value of the deviating component ($12 \times \frac{1}{4}$) will then be 9 miles an hour. In paragraph 245 it is stated that for the rifle at this range 1 point

compensates for a direct cross wind of about $4\frac{1}{2}$ miles an hour, therefore for this wind 2 points will be required. But the wind being from the right, this, if the rear sight, model 1879, is used, should be decreased $\frac{1}{2}$ point (the correction for drift), leaving $1\frac{1}{2}$ point to the right for the approximate adjustment of the wind-gauge. If the velocity of the wind had been estimated as 15 miles an hour, the approximate adjustment would have been 2 points to the right, thus determined: $15 \times \frac{1}{3} = 11\frac{1}{2}$; $11\frac{1}{2} \div 4\frac{1}{2} = 2\frac{1}{2}$; $2\frac{1}{2} - \frac{1}{2} = 2$ points. If the velocity of the wind had been estimated as 10 miles an hour, the approximate adjustment is found to be $1\frac{1}{2}$ point, thus: $10 \times \frac{1}{3} = 7\frac{1}{2}$; $7\frac{1}{2} \div 4\frac{1}{2} = 1\frac{1}{2}$ nearly: $1\frac{1}{2} - \frac{1}{2} = 1\frac{1}{2}$ point.

279. These adjustments are only approximate, none of the elements entering the calculation being absolutely correct. The soldier's estimate of the velocity of the wind, and even in some cases of its direction, is often incorrect; the fractions expressing the proportionate value of the deviating component are but approximations, as are also the compensating values of a point on the wind-gauge at the different distances.

280. In determining the proper elevation for different ranges it is essential, when great refinement is required, that the rear sight should have been graduated for the different trajectories under some standard barometric and thermometric reading. If for the barometric standard its normal height at the level of the sea is taken, and a standard temperature of 60° adopted: the proper corrections for different altitudes above the sea, and for different temperatures, can be obtained from Part VI., Chapter III.

281. With military rifles and ammunition the varia-

tions incident to the arm and its cartridge, and also those due to their employment by different soldiers, are so complex, and their influences upon the trajectory so interwoven and intimately connected, that a graduation determined in this manner by a single expert for one particular arm might or might not be the one best adapted for the average rifle. It has therefore been deemed of the most practical value to place upon the rear sight graduations determined from a long course of experimental firing at the National Armory, care being exercised, however, that no abnormal atmospheric conditions are permitted to enter the problem. As the circumstances of the firing at the Armory are very nearly those mentioned in the preceding paragraph, the corrections given in the chapter there alluded to afford an approximate guide in estimating the elevations required. As, however, the application of these corrections will give results varying materially for each particular rifle and for each soldier, the best results will only be obtained when the soldier has kept a full record of his practice with his own rifle at each range, at some known height above the level of the sea, and at some known temperature. The conditions of that firing and the elevations then determined afford the best possible standard, to which the corrections of Chapter III. of Part VI. can then be applied.

282. Paragraph 723 gives the further corrections required by a head or rear wind, and paragraph 702 those necessitated by changes in the initial velocity of the cartridge. These latter variations are not fully known to the soldier; the velocity stamped on the paper box of cartridges should, however, always be

noted, and the Table applied if the velocity differs from that of cartridges previously fired.

283. After the soldier has adjusted the sight, and while he is waiting to be called to the firing point, he should take the position he proposes to assume in firing, and aim and pull trigger several times. This will serve to steady him and also to accustom his eye to the light and its effect upon the sights.

284. The estimated adjustment of the sight having been made and the soldier called to the firing point, he will take the position he generally adopts, load, *examine again the adjustment of his sights*, and then (noticing that he is looking at the proper target) aim carefully and steadily at the lower edge of the bull's-eye, or rather at the line of white just under that division. Great care must be taken that the rifle is not inclined to either side (which can be best avoided, when firing at the longer ranges, by observing whether the leaf is perpendicular), and that the amount of front sight taken is the same as that usually seen by the soldier. But slight changes in this latter particular produce considerable effect upon the target, the vertical position of a hit being altered a distance greater than half the height of the bull's-eye by changing from a fine to a half sight when firing at 1,000 yards. At the short and mid ranges a half sight should generally be taken; at the longer ranges, especially if the light is bad, it may be better to take a full sight. Care must also be taken that the front sight is centred in the rear sight notch, or that when looking through the notch the same amount of light is seen on either side of the front sight.

285. In aiming, the advice and directions given in

the sighting and in the position and aiming drills should be followed. It is especially advantageous to aim at the lower edge of the bull's-eye, endeavoring to cover no portion of it; if this plan is not followed it is difficult to determine just how much of the bull's-eye is covered, and at the moment of discharge it is even possible for the rifle to be directed above the bull's-eye, without the soldier being aware of his error. This method of aiming also possesses the advantage of tending to impress upon the soldier the necessity for directing his fire just below the object he desires to hit, and thus, in action, adding to the chances for a direct hit, those offered by the ricochet.

286. If the soldier finds that he is unsteady, especially when about to fire at 200 or 300 yards, the piece should be lowered from the aim, more than once if necessary, and at each time a moment's rest taken; for if the first effort to get a good sight is unduly prolonged, and he fires while unsteady, not only may that shot be poor, but nothing is learned from it upon which corrections for the succeeding shots may be founded.

When firing lying, the stability of the position permitting great deliberation, the soldier, after the general direction of the piece has been given, should glance at the wind-vane, or flags, or if the range is not provided with those accessories, at any surrounding trees or high grass, or if others are firing at different ranges, at the smoke from their rifles, and observe whether any sudden change has occurred in the direction and force of the wind; if any changes are noticed the aim should be discontinued, and the adjustment of the sight corrected accordingly. (This,

however, would apply only when about to fire the first shot; later in the firing it will be better to estimate the effect of the changed conditions upon the position of the hit, and make a corresponding change in the point of aim.) If no changes are deemed necessary, the aim is completed and the piece fired, particular care being taken to observe the point aimed at at the moment of discharge, the soldier always naming to himself the value and position of the expected hit.

287. Immediately after firing the soldier should throw open the breech-block, and, to keep the fouling soft, breathe or blow into the chamber, and, especially if firing at the longer ranges, observe at the same time whether the atmospheric conditions are still those for which the sight was adjusted. By this time the shot will have been signalled; if the point at which the final aim was taken is hit, the sights only require the modification demanded by the amount of fouling and heating of the barrel, which, in its turn, will depend upon the temperature and hygrometric condition of the air,

288. If the hit is not placed as anticipated, in addition to the correction for fouling, etc., the sights should be altered an amount corresponding to the horizontal and vertical distances between the expected and realized hit. For instance, in firing with the rifle at 600 yards, the final aim caused a 4 at 7 o'clock, well in, to be expected; the shot is signalled as a 1 o'clock 3, well out; it is then too far to the right a distance (which must be judged by the eye from the firing point) about equal to once and a half the width of the bull's-eye; referring to paragraph 247 it is seen that the wind-gauges should then be moved about

$\frac{1}{2}$ point to the left. The hit is a little more than $1\frac{1}{2}$ times the length of the bull's-eye above the point aimed at; referring to paragraph 248, it is seen that the elevation should be lowered about 25 yds.

289. To make this method of correcting for the second shot of any value, the atmospheric conditions should remain unchanged, and what is of great importance, the soldier's judgment of his aim at the moment of discharge should have been correct. The greater steadiness of the lying position will then give to this method its principal value at the mid and long ranges. If the soldier is habitually uncertain where he holds at the instant of firing, accuracy becomes mainly a matter of chance, and the sights first adopted will perhaps answer the purpose during the remainder of the score as well as any others that he might happen to select.

290. If the first shot misses the target and the dust shows the direction of the error, the correction for the second shot should be made as indicated in paragraph 289; but if no dust or other indication of the nature of the error is noticed the direction of the miss must be inferred from the conditions of the weather. If a strong side wind was blowing the miss was more than likely to either the right or left; if there is but little wind, if the day is either exceedingly dry or very damp, very bright or very dark, or if there is much mirage, or a strong wind in the direction of the plane of fire, the elevation assumed was probably incorrect.

291. In the first case if the soldier from long firing has discovered the usual nature of his errors in estimating the deviating effect of the wind, he will be able to judge on which side of the target the miss was

probably made. If this knowledge has not been obtained, it will generally be safest to assume that a sufficient allowance was not made, and that the shot passed the target on the side opposite to the wind. The wind-gauge should then be moved toward the wind a distance depending upon the range at which firing is being held (see the preceding chapter), and corresponding to $\frac{1}{4}$ of the width of the target. If the direction of the error has been correctly judged this will change on the next shot, if firing at short or mid ranges, a very close miss into a centre, well out, on the opposite side of the target; or a miss of one or two feet into a bull's-eye or a centre on the same side of the target. At the long ranges a very close miss would be changed to an inner on the opposite side of the target, misses of one or two feet to centres or bull's-eyes. If firing at 600 yards, a miss of four feet, if at 1,000 yards one of eight feet, would be brought on the target.

292. After correcting in this manner, if the target is not found on the second shot and the soldier is still convinced that his errors are horizontal rather than vertical, he was probably mistaken as to the side on which the misses were made. If, for instance, he has been moving the wind-gauge to the right, it should now be moved to the left and to a distance beyond the position originally selected for the first shot equal to the correction made for the second shot.

293. If the target is again missed, make the correction in the direction first chosen, but with double the amount first selected. If still a miss, then apply this doubled correction in the opposite direction. If after these different trials no hit is obtained, abandon the theory of lateral errors and alter the elevations.

294. Whenever making changes in the elevation, after missing on the first shot, and there is nothing to indicate whether the shot was too high or too low, it is generally safest to assume the former to be the case, as a low shot will often raise a dust visible from the firing point, while a shot over the top of the target might not.

If firing at 500 or 600 yards, when very great errors in the elevation are improbable, it should be decreased sufficiently to lower the second shot about half the height of the target (the proper corrections for the different arms at different ranges are given in the previous chapter); but if firing at 800 or 1,000 yards, the greater chances for error make it more advisable to change the elevation enough to produce a fall in the bullet equal to about $\frac{1}{2}$ of the height of the target (see paragraph 255). If the soldier does not remember these corrections in the elevation for the different ranges, the aim for the second shot should be taken at the bottom of the target, or slightly below it.

295. If on the second shot the target is not hit, increase the elevation above its first adjustment as much as it was previously lowered, or aim with the first elevation at the top of the target. If a miss still results, lower again, but to double the amount first selected, and if a hit is not yet made increase the original elevation by this latter amount.

296. If a hit is made when aiming at either the top or bottom of the target, the elevation should be corrected for the next shot as explained in paragraph 288 and the aim then taken at the lower edge of the bull's-eye for the following shots.

297. It will often be advisable to combine the hori-

zontal and vertical methods of feeling for the target, alternating in successive shots the direction in which the sights are moved. The soldier must not temporize or make these corrections in a feeble manner, if unhesitatingly applied, and with their full value, the target will generally be quickly found; whereas if only slight changes are made a number of shots, especially at the long ranges, may be fired without the nature of the error being discovered, or a hit obtained.

298. If the target is hit on the first shot and the corrections then made result in a bull's-eye or close centre for the second shot, the sights should not be changed during the remainder of the score (except such a slight change in the elevation for the third shot as it may be deemed necessary to make on account of the degree of fouling and heating of the barrel, depending upon the weather), but the variations which may occur in the conditions affecting the elevations or wind allowances, *unless they are very considerable*, should be allowed for by altering the place on the target upon which the rifle is held.

299. This method, while generally advantageous, is especially so when firing in a puffy wind or in an alternately bright and dark light. In these cases there is less danger of error and it is much simpler to estimate the direction and distance upon the face of the target of the probable deflection of the bullet, and to select a new point of aim accordingly, than to attempt to convert the deviation into its corresponding equivalent on the sights, with all the possible resulting inaccuracies. Moreover, if perpetual changes are made in the sights, the idea of an origin from which the effect of the changing conditions can be judged and al-

lowed for is quickly lost, and the various corrections will soon partake of the nature of experiments rather than well-judged adjustments; while if the sights are not altered, the fixed sight, a certain point of aim, and the conditions existing at the second shot, all form a valuable basis for comparison with the subsequent conditions.

300. Whenever firing in a puffy wind or in one subject to frequent changes in direction, the soldier should, as far as possible, endeavor to fire his shots under similar conditions, waiting a short period whenever necessary until they become the same as those in which previous shots were fired. If this can be done he will be able, without corrections in the sight, to hold on the bull's-eye throughout the score.

301. When such a method cannot be followed, the wind-gauge should be adjusted for what is judged to be the average force and direction of the wind, and when this is ascertained, to allow for changes by altering the point of aim on the target.

302. The effect of changes in the temperature upon the elevation is considered in paragraph 708. After the proper adjustment of the sight has been determined upon, it will rarely happen while firing a single, or even several consecutive scores, that such changes can occur in the temperature as to make further correction necessary. If the first shot has been fired from a clean, cool gun, the subsequent fouling and heating of the barrel and the different vibrations of the latter, which are caused by the heating, will generally make necessary a slight increase in elevation for the second shot, and often an additional increase for the third shot. This should be followed, in some cases where a

number of shots are fired without cleaning or without any considerable interval, by a slight lowering of the elevation after additional shots.

303. The amount of these corrections is considerably affected by the amount of moisture present in the air, in that it so largely determines the character of the residuum in the bore. On damp days, especially if they are also warm, a much lower elevation should be first selected, which after the first shot should be followed by only a slight increase; on a very dry day, even if slightly warmer, the original elevation must be higher, and the increase after the first and second shots made greater.

304. The absolute amount of these corrections varies greatly for different guns, although they may be fired under the same conditions; even their approximate extent for the various ranges cannot therefore be stated, but must be determined from the experience of the individual soldier.

305. Such measures as will prevent the gun heating rapidly, or will keep the fouling soft and of a uniform character, should always be resorted to; to this end after each discharge the empty shell should be at once ejected, the chamber blown or breathed into several times, and the breech-block left open to permit a circulation of air, until the time arrives to load for the next shot. With these precautions much smaller changes will be necessitated in the elevation, and the shooting should be more uniform; without them, especially in hot, dry weather, the residuum becomes hard and increases in amount, and an additional element, affecting the initial velocities and therefore the height of the point struck, is introduced. Besides,

under these circumstances the fouling is more apt to cause leading of the barrel with its resulting wild shooting.

306. The effect of clouds or bright sunshine is mainly noticed in the elevations. On bright, hot days there is greater probability of local currents, produced by the differently heated ground, which, unless the soldier is thoroughly familiar with the topography of the range, will cause unaccountable deflections. On these days also there is a possibility of portions of the range being in shade; that particular ground will therefore be cooler and consequently the adjacent air (being of a greater density) will offer increased resistance to the bullet. Under these conditions there is greater probability of inaccurate shooting.

307. When the day is overcast, the light being of a dull gray, and evenly diffused, it is more likely that the air over the whole range will be of a uniform temperature and free from local eddies. Such weather is the most favorable for accurate practice.

308. When the light is alternately bright and then shaded by clouds, the difficulties confronting the soldier are much increased. These changes of light, besides affecting the conditions which cause a deflection of the bullet, also have a considerable influence upon the manner of aiming.

309. Changes in the brightness of the light seem to affect the aiming of different soldiers in various ways; suggestions which might prove of value in many cases might therefore prove erroneous in others. It is, however, generally found, if shooting on a cloudy day and the sun appears and lights up the target, that the elevation should be diminished, while if shooting on

a bright day and the sun become obscured, the elevation should be increased.

310. In cases where the light is frequently changing it is essential that the soldier should prolong his aim until his eyes become accustomed to the altered conditions and until he becomes assured that his observation is correct.

311. When shooting on hot, cloudless days, especially if over low, level ground, or over ground not covered with grass, the target will appear to be raised higher than it really is, the bull's-eye to be elongated vertically, and its outlines and those of the target to have a wavy and ill-defined appearance.

312. This mirage is more noticeable as the firer is closer to the ground; it will then be more frequently observed by the soldier when firing lying, than when firing either kneeling or standing. As it affects objects less as their distance from the ground is increased, the upper instead of the lower part of the bull's-eye should be aimed at, and as the true position of the target is below the apparent, the elevation should, if the mirage is considerable, be decreased.

313. This can be illustrated and the extent of its effects determined if, early in the morning, before the mirage is noticeable, a telescope is directed at the target and so adjusted that the two lower corners of the target just touch the lower arc of the circumference of the field of view; the telescope should then be clamped in position. Later in the day, before commencing firing, examine the position of the target in the field of view; if there is much mirage, the target will appear considerably raised, and in some cases also laterally displaced; the extent of this ap-

parent movement will be shown by comparing the second with the first position of the target, and should be measured by the eye, using the entire target or the bull's-eye as a unit of measure; the elevations which would otherwise be selected by the soldier should then be decreased by the amounts corresponding to these displacements. (Paragraphs 243, 248, or 255.)

314. When all the influences affecting the elevations and the accuracy of fire are considered, it follows that the best results will generally be obtained on warm, damp days, with the sky uniformly overcast, and that on these days less elevations and smaller changes will be required. The reverse of these effects obtains on a hot, bright day.

315. It has already been stated that the soldier, if he desires to improve or to attain even fair results, should be particularly careful to notice, on the first few shots, the exact point of aim as his piece is discharged.

The same precaution should be observed throughout the score.

316. With very many soldiers, even the most expert shots, some slight motion of the piece takes place between the time when they intended to pull the trigger and the instant when the object is accomplished. If the soldier does not notice this motion, he ascribes to extraneous influences his error, and corrects accordingly, whereas it was, in reality, the holding that was in fault, and perhaps the adjustment of the sights and selection of the point of aim correctly made. For this reason it is often unadvisable to change the sights if a single shot goes wild, especially if the preceding shots were good.

317. Another important factor in the soldier's instruction is his individual target record, and the accuracy with which it is kept. Every shot fired should be recorded, with the estimate of the wind and weather, the adjustment of the sights and the point hit on the target; in this way the necessity for slight corrections in the sight or point of aim, which otherwise might escape notice, frequently becomes evident. To be of any particular value, poor as well as good scores should be honestly entered; the record being the private property of the soldier, he is not required to exhibit the history of his failures; but if they are recorded and carefully studied, he may be able to avoid them in future, whereas if not entered, and therefore soon forgotten, later firing, even under the same conditions, may still be more or less experimental.

318. This is especially important at the longer ranges, where the secret of success lies mainly in the ability to determine the proper amount for holding on or off, above or below, the bull's-eye, or even the target, together with the power of noticing quickly and accurately the changes which occur in the atmospheric conditions. This knowledge can only be satisfactorily acquired by the experience gained in actual firing and by studying the records of the results.

319. If the soldier expects to participate in matches or competitions, his target record book, if carefully and honestly kept, will prove to be of great value, not only from the fund of information it contains, but also as affording him the means of forming a good estimate of the scores he may fairly expect to make.

320. It may be recognized as an established fact that any body of men, where all have received careful

instruction and have reached a fair state of proficiency in the use of their weapons, will be of more value upon the battle-field than if a few of their number had become even more expert but the instruction of the remainder neglected in order to reach this result.

It is therefore incumbent upon the company commander to endeavor to make good average shots of all his men, devoting even more time to the poor than to the expert shot.

In instructing the soldier, the company commander should appeal to his common sense, explaining in detail and showing him in all cases the reasons for the methods he prescribes. The individual intelligence of the soldier will thus be brought into play and his value in the dispersed order of fighting which is made necessary to such a great extent by the power of the present small arm will be greatly increased.

It should especially be impressed upon him, that for efficiency in action and effectiveness of fire against the objects that will then be presented as marks, he should endeavor to become a good line shot, as such a shot, even if a little high or a little low, might yet hit an enemy and produce a good effect, whereas even a small deviation from the right direction would render it useless.

PART III.

CHAPTER I.

SKIRMISH FIRING.

321. WHEN the soldier has completed the prescribed course of individual firing at known distances he will be exercised in firing as a skirmisher at figure targets at varying and undetermined distances. The practice will be divided into individual and company firing. For both classes the men will fire in such positions as enable them to take the greatest possible advantage of the accidents of ground, or to deliver their fire with the greatest accuracy.

322. As the object of the skirmish firing is to give the soldier practice in promptly and correctly estimating the continually varying distance which separates him from his target, and to afford him instruction in firing at objects bearing some resemblance to those which would be presented to his aim in action, the greatest benefit can be obtained from it when it is conducted over ground somewhat broken and wooded, or at least over ground with which the soldier is not familiar. As this will not often be possible, when the regular range is used for the firing, the figure targets employed should be placed a few yards either in front or beyond the permanent targets, and the range further prepared by removing the stakes which mark the firing points, and also by removing to such an extent as may be practicable such other objects as might, by

his familiarity with their usual position, afford the soldier any extraneous assistance in estimating the changing distance.

The officer conducting the firing should also be careful not to command a halt in the immediate vicinity of one of the regular firing points, where from the appearance of the ground the soldier might the more readily determine his position.

323. As this firing will require alterations in the range which would interfere with its use for the regular target practice, the post commander should designate the period to be devoted to the skirmish firing, which should then be continued (unless unfavorable weather intervenes) on successive days until completed by all the companies of the garrison.

Individual Skirmish Firing.

324. The individual skirmish firing will be divided into the preliminary and additional practice and into the regular or record practice; to which terms will be attached the same meaning as given in paragraph 204; only the result of the regular practice will be considered in determining the soldier's classification.

325. For the individual practice, both preliminary and regular, the company will be divided into squads of from 8 to 16 men each, as may be most convenient, each squad being under the direct command of a lieutenant or sergeant, the company commander, however, exercising a careful general supervision over the practice.

The squads will be so arranged that each sergeant will receive instruction in the firing itself, as well as in controlling the fire of his squad.

326. The squads in succession will be deployed as skirmishers with intervals of not less than five yards between the men, at about 600 yards from the targets for those firing with the rifle, and at about 500 yards for those firing with the carbine. At the command or signal "*Forward, MARCH,*" the line will advance, first at quick and then, at the proper commands, at the double time until the signal "*Skirmishers, HALT,*" which will be *immediately* followed by the signal "*Commence, FIRING,*" when the sights will be adjusted to the estimated distance, the rifle or carbine loaded, and the position for firing assumed. After the last note of the signal "*Commence, FIRING,*" the firing will be opened and continued until the number of shots specified for the particular practice have been delivered. The firing will cease at the *last note* of the signal "*Cease, FIRING,*" which note will be sounded exactly thirty seconds after the last note of the signal "*Commence, Firing.*"

327. As soon as the firing is completed the line will advance without delay in the same manner as before the first halt, at quick and then at double time, until the succeeding halt is ordered.

Having approached in this manner a point a little more than 200 yards from the targets, the signal, "*To the rear, MARCH,*" will be given, when the manœuvring to the rear and the firing will be conducted as upon the advance. The rifles will be pointed in the general direction of the targets when manœuvring to the rear.

Five halts will be made in advancing and five in retiring; they will be at approximately regular intervals, dividing uniformly the ground manœuvred over.

328. The skirmish practice will always be preceded by several manœuvrings in advance and retreat, using dummy cartridges or firing blank cartridges. The course will then be conducted as follows :

329. For recruits: Preliminary, 1st. One manœuvring at the D silhouette, pasted on the reverse side of a paper target B or on the corresponding cotton cloth, one shot being fired at each halt and the result marked after each signal "*Cease*, FIRING" (the advance being delayed for that purpose), the white disk being used for hits on the silhouette, the red disk for hits on the B target and the danger flag for complete misses. Preliminary, 2d and 3d. One manœuvring at the E and F silhouettes respectively, conducted as above described. Preliminary, 4th, 5th and 6th. One manœuvring at each of the skirmish targets D, E and F (the silhouettes on the iron frames), firing one shot at each halt, but with no indication of the result given until the manœuvre is completed. Preliminary, 7th. One manœuvre at a group target composed of one of each of the figures D, E and F, the standing figure in the centre, and the kneeling and lying figures on its right and left respectively; the distance between the centres of the figures being one yard (the target as thus arranged is illustrated by the flanks of Target G, Plate XIX.). One shot will be fired at each halt, but with no indication of the result given until the manœuvre is completed. Preliminary, 8th. Same as the seventh preliminary manœuvre, except that two shots will be fired at each halt (see paragraph 872).

330. With the completion of the individual preliminary skirmish practice the recruit's firing for his first season will generally be concluded. If, however, in

his regular known distance and his skirmish firing he has shown a fair proficiency, he will (in the discretion of the company commander) be given such additional skirmish practice as may be deemed advisable and then advanced to the skirmish firing for record, as prescribed in paragraph 332, for the soldier's second season's practice. This final record firing, if once begun, must be completed and the recruit classified according to the results obtained.

331. In the second season's course, the 1st, 2d and 3d preliminary manœuvres will be the same as 4th, 5th and 6th as prescribed for recruits, and the 4th preliminary manœuvring will be the same as the 8th as prescribed for recruits.

These may be supplemented by additional skirmish practice, in the discretion of the company commander.

332. In the second season's course the regular skirmish practice will comprise four manœuvres, conducted as specified for the 8th preliminary for recruits. All of this regular firing will be included in the soldier's record and considered in his classification. When once commenced it will be completed without interruption, though not necessarily on the same day, no other shots being fired by the soldier in skirmish practice during its prosecution.

333. In subsequent seasons the preliminary course will consist of the 4th manœuvring as prescribed for the preliminary practice of the second season, which may be supplemented by additional skirmish practice in the discretion of the company commander.

The regular course will consist of two manœuvres similar to the four prescribed for the second season, and the rules of the preceding paragraph as to its un-

interrupted prosecution will govern (see paragraph 872).

334. In the individual skirmish practice the targets will be arranged in line with a distance of not less than five yards between centres, corresponding to the intervals between the skirmishers ; one target being assigned to each man. Numbers will be placed on the butt, above each figure or target, that each soldier may be able to distinguish his proper target. A hit in any portion of the target, whether from direct or ricochet fire, will be counted and scored three if in target D, four in target E and five in target F (consult paragraph 338).

335. In the individual practice the number of cartridges carried by the soldier need not be limited to those he is to fire, but the number fired will be only as prescribed for the particular practice, though a cartridge may be substituted for one that has missed fire. If a soldier's gun becomes disabled the incomplete score will not be considered, but the practice repeated.

In the regular practice five points will be deducted from the soldier's score for each failure to fire two shots during the halt, for each shot fired in excess of that number, and for each shot fired *before* the last note of the signal "*Commence, FIRING,*" or *after* the last note of the signal "*Cease, FIRING.*"

COMPANY SKIRMISH FIRING.

336. This firing will follow the individual skirmish practice and for it the line will be formed with one yard between the files, as prescribed by the infantry drill regulations (except that there will be no reserve).

For organizations armed with the rifle the line will be formed at about 600 yards from the target ; for those armed with the carbine at about 500 yards. The advance and retreat, and the firing will then be conducted in the manner prescribed in paragraphs 326 and 327 for the individual skirmish practice.

337. The practice will always be preceded by several manœuvrings in advance and retreat, using dummy cartridges or firing blank cartridges. The course will then consist of the following :

Preliminary ; one manœuvring in advance and retreat, each soldier firing two shots at each halt.

This may be supplemented by additional company practice, in the discretion of the company commander.

Regular ; four manœuvrings in advance and retreat, each soldier firing two shots at each halt.

After regular skirmish practice has once commenced, it will be continued (though not necessarily on the same, or even consecutive days) until completed ; no other target practice of any kind being permitted, by that company, during its prosecution.

338. The target (Target G, see Plate XIX.) for the company firing will be a line of skirmishers represented by the three kinds of targets employed for the individual skirmish firing. The different figures will be arranged alternately (consult paragraph 390), and at equal intervals ; the distance between the centres of any two consecutive standing figures being three yards. The total number of figures constituting the target will be equal to the number of men in the firing line of the company.

The men will not be expected throughout the prac-

tice to aim always at the same figure, but will direct their fire at such points of the supposed hostile skirmish line as they may from time to time select, or as the company commander in general terms may direct. Each hit in any figure whether from direct or ricochet fire will be scored one, and the results of the firing expressed by the percentage made of the total possible score; provided that in counting the hits, in this as in all other firing at these targets, only those are considered that have struck within or on any portion of the iron frame, omitting hits in any portion of the paper silhouette that may happen to project beyond the frame which is considered as the actual target.

339. Before commencing practice, 20 rounds of ammunition will be issued to each man who is to fire, and the company carefully inspected to see that no additional cartridges are carried by any soldier.

Every cartridge lost after the advance is commenced, and every miss-fire, will be considered a miss. A cartridge which fails to explode may, in the discretion of the soldier, be replaced by another at that halt, but at the expense of the cartridges reserved for other halts, at some one of which but one shot can then be fired.

Guns which may become disabled will be replaced by others which for that purpose will be carried by the file closers. At the next halt the soldier, in addition to the usual shots, will then fire those which he was not able to deliver at the preceding halt.

340. The regular practice will always be conducted by the company commander; he will be careful to order the halts as required by paragraph 327, and with his lieutenants and sergeants will see that the align-

ments and intervals are preserved and that each man fires two shots and no more at each halt.

For each shot fired in excess of that number by any man at any halt, except as provided in the preceding paragraph, even though the total number of 20 shots may not have been exceeded, for each failure of any man to fire two shots during the halt, unless he has expended the ammunition in replacing a defective cartridge or his gun becomes disabled, for each shot fired *before* the last note of the signal "*Commence, FIRING,*" or *after* the last note of the signal "*Cease, FIRING,*" one hit will be deducted from the aggregate score of the company.

341. In determining the composition of the firing line of the company, the sergeants, musicians, and those recruits who have not participated in the individual skirmish practice for record, as authorized by paragraph 330 will first be excluded from consideration. The line will then be composed of ninety (90) per cent. of all the remaining enlisted men who are present at the post. If from sickness, or other causes, beyond the control of the post or company commander this proportion of these enlisted men cannot be obtained for the practice, such a number of the company musicians or sergeants will be added as may be necessary to bring the firing line up to the prescribed strength.

342. The post commander will exercise a direct supervision over the company skirmish practice. He will select days for the practice when the company is not depleted by details for detached service, revoking any details that could be deferred until the skirmish firing is completed, and giving the company com-

mander all possible aid to bring out every man for instruction; he will examine the list of names of the men proposed for the firing line, verify it in connection with the requirements of the preceding paragraph, see that the target is composed of as many figures, properly arranged, as there are men in the company firing line, and will also direct the supervision of the scoring as required in paragraph 499.

343. As through inadvertence it is possible that some company commander might so direct the different halts in advance and retreat as to give his company some advantage, or place them under some disadvantage, as compared with other companies at the same or different posts, the post commander, considering all the circumstances of the firing which have come under his supervision, will decide immediately upon the conclusion of each practice, and before the score is known, whether the result is to be rejected or recorded. This decision, once made, should under no circumstances be altered. A rejected practice will be immediately followed by another until one is made which meets the approval of the post commander; its record will then replace that of the rejected manœuvre.

CHAPTER II.

VOLLEY FIRING.

344. UPON the completion of the skirmish practice the company will be exercised in firing by volley. The object of this practice is not only to give the soldier instruction in a class of fire that will, under

some circumstances, be employed in action, but also to make the company and subordinate officers familiar with this manner of controlling the fire of their command; to accustom the men when in ranks to the habit of relying upon the judgment of their officers as to the range and approximate adjustment of their sights, and as to the extent of their fire and the most suitable time for its delivery.

345. Volley firing can be most advantageously employed to meet the earlier stages of an infantry assault, or to resist, either in line or square, a sudden attack of cavalry. It can be used early in the action in assisting the officer, noticing the relative positions of the hostile forces and of the dust raised by the simultaneous fall of many bullets, in determining the corrections that may be required in his estimate of that distance.

Its moral effect upon the enemy when at some distance also exceeds that produced by independent fire, and may therefore unduly hasten their deployment, and the interval between the volleys permits at least a partial clearing away of the smoke of the discharge and consequently a better view of the object under fire.

346. Before commencing the course of volley firing the company will be drilled in aiming and pulling trigger by volley and in similar practice with blank cartridges. In this exercise, as well as in the firing to follow, no effort will be made to establish a regular cadence in the command but the men so taught that without anticipating the order to fire, they will always wait until it is given, which should only be when all the pieces appear to be steady.

The company commander will however be careful not to unduly delay the command for the delivery of the volley.

347. The course of volley firing will then comprise one preliminary series of five rounds each at the distances 600, 800 and 1,000 yards for organizations armed with the rifle; and at 500, 600 and 800 yards for those armed with the carbine, supplemented by such additional practice as the company commander may desire (see paragraph 872).

348. The regular or record practice will comprise four series of five rounds each at the distances prescribed in the preceding paragraph.

After the regular volley firing has once commenced, it will be continued (though not necessarily on the same, or even consecutive days) until completed, no other target practice of any kind being permitted by that company during its prosecution.

349. The target for volley firing will be composed of three lines in closed order, of the silhouettes used in skirmish practice; the first line formed by sixteen of the figure F, the second by sixteen of the figure E and the third by sixteen of the figure D (the appearance of this latter line is illustrated by Plate XIX., Target H); the line of kneeling figures being placed at the distance designated for practice, the line of lying figures ten (10) yards directly to its front and the line of standing figures twenty (20) yards directly to its rear.

Each hit in any figure whether from direct or ricochet fire will be scored one, and the results of the firing expressed by the percentage made of the total possible score; hits without the iron frame being

however deemed misses as directed in paragraph 338. Cartridges failing to explode will not be replaced by individual shots, but scored as if they had missed the target.

350. The regular practice will always be conducted by the company commander, the composition of the firing line determined in the manner prescribed in paragraph 341 and the post-commander's supervision exercised as required in paragraph 342 for the regular company skirmish practice.

351. For the volley firing the company will be deployed in single rank, with an interval of one yard between the men. At the shortest prescribed distance (600 yards for rifle, 500 yards for carbine) the firing will be from a sitting or kneeling position; at the next distance (800 yards for rifle and 600 yards carbine) from a prone position and at the longest distance from any lying down position; the commands for the firing being in all cases those prescribed by the drill regulations.

352. Any men joining the company before the commencement of its practice season, who in a former enlistment may have completed the course prescribed for a second season's firing, will not be regarded as recruits within the meaning employed in this course of instruction but will be given the course (including the company skirmish and volley firing) as laid down for a second season's practice.

Such of these men as may join a company after the commencement of its practice season will be considered recruits as far as the season's firing is concerned and to them the provisions of paragraphs 330 and 502 will apply, but the following year they will take the second season's course.

Men who may re-enlist in the same company will be treated, for the purposes of this course of instruction, as if their service were all one enlistment.

Officers whenever joining a company either by appointment, transfer, or promotion will commence their firing in that company with the course for the second or subsequent seasons, depending upon their previous practice.

353. The results of the soldier's classification as determined by the regular course of individual known distance and skirmish firing, and the results of the regular company skirmish and volley firing will be utilized as a means of estimating the proficiency of the men and the probable comparative effect of the company's fire in battle. It is therefore essential for a correct judgment that the practice should be conducted in accordance with the letter and spirit of the foregoing requirements and that all possible endeavors should be made to secure fairness in every detail.

FILE FIRING.

354. Near the close of the target season, and after the men have been thoroughly instructed in the regular range practice, they should as far as practicable be practised in firing by file.

355. The object of the practice is to instruct the men in the rapid as well as accurate delivery of their fire, and to accustom them to the employment of a class of fire that would probably be used to a greater extent than any other in repelling the latter stages of an assault.

The target should be situated at known distances, as would frequently be the case, at least with a close

degree of approximation, for troops in position acting on the defensive.

356. The practice will be held at a target composed of a line of sixteen of the skirmish figures D, arranged as illustrated by target H, Plate XIX., and before commencing firing the men directed to make the proper adjustment of the sights.

357. The practice will be held at 200 yards standing and at 300 yards kneeling, the company being in single rank. The firing will be conducted as prescribed by the drill regulations, except that instead of terminating it by the command, *Cease FIRING* (which would result in the firing of an unequal number of shots by the different men), the company commander will indicate, between the first and second preparatory commands, the number of shots to be fired. This is moreover necessary that he may more intelligently direct the extent of their fire, particularly as regards the expenditure of ammunition. Five will generally be selected as the number of shots to be fired at each range.

358. The time required for the firing from the command, *Commence FIRING*, until the last shot is fired, will be noted. While it should be impressed upon the soldier that if the accuracy of his aim is maintained, the efficiency of the fire will be increased directly as the time required for its delivery is diminished; yet he should be cautioned that the period required for deliberate aim should not be abridged, but rapidity of fire obtained only by more expeditious loading and quick handling of his piece.

359. The result of the firing will be expressed by the useful effect, which shows the number of

hits that would have been made by 100 men, firing for one minute with the same accuracy and at the same rate as that for the company. This is obtained by multiplying the actual number of hits by 100 (the standard number of men) and dividing the result by the product of the number of men firing by the number of minutes required for the delivery of the fire. As an illustration, let it be supposed that a company of 47 men firing 5 shots each make 159 hits, and that the time required is 1 minute and 30 seconds, then the

useful effect is obtained as follows: $\frac{159 \times 100}{47 \times 1\frac{1}{2}} = 225$,
the useful effect.

360. It will generally be found, when first firing in ranks, that the average soldier, or even the expert shot, will fall considerably below the standard of proficiency he had attained in individual practice. This is probably due to the different surrounding circumstances, involving, as they do, hastened action and possibly increased excitement. But these to a limited extent are the very conditions that soldiers would encounter in action, and until they have become able to deliver their fire coolly and accurately, either as skirmishers or by volley or file, the practical part of their instruction in the use of their weapons cannot be considered as complete.

361. In the volley and file firing, but more especially in the company skirmish firing, the probability of hitting will be increased if the soldier, instead of directing his fire on the targets immediately in his front, aims somewhat more toward the diagonally opposite flank of the supposed hostile line. Unlimited discretion in this respect should, however, not be

given the soldier, but the officer in command should designate the portion of the line upon which he desires each soldier to direct his fire.

CHAPTER III.

PRACTICE AT DISAPPEARING AND MOVING TARGETS.

362. PRACTICE at some form of moving target should be frequently conducted, as firing at fixed targets has a tendency to make men too deliberate for field firing. Either a disappearing target, or a running target may be employed.

363. When no special disappearing target can be procured, any one of the forms of target described in the following chapter may be used; the target being turned down or withdrawn until a bugle signal is made at the firing point, when it is exposed and kept in the firing position until the signal is repeated.

The unavoidable variations in the period during which these targets are visible make them, however, much inferior to those purposely constructed for this special class of fire, and it will be better to use, when it can be obtained, a target similar to that described in paragraphs 442-445.

364. For this practice, the soldier being at the firing point and at a *ready*, with the piece loaded, the signal is given on the bugle; the marker pulls the cord which brings the target into view, until the target is at right angles to the line of fire, and at the end of the prescribed number of seconds releases his hold on the cord, when the target disappears.

The end of the firing period may be determined by the marker, according to directions previously given, or indicated by a second bugle call from the firing point.

365. If the target has been struck while exposed, the marker pulls it into view, indicates by the proper marking disk the value and position of the hit, then closes the target and pastes over the shot hole. If no hit has been made, the marker will wave the red flag.

366. When first firing at this target an interval of 4 seconds should be allowed; this may subsequently be reduced to 3 seconds as the men become more expert, and afterward increased to 10 seconds, to permit of reloading and firing a second shot. The practice will first be at 100 yards and afterward increased to 200 yards.

367. For running targets the Cushing rolling target (paragraph 420) should be employed. The track should be raised at either end, forming two inclined planes, and two markers' shelters so placed as to permit of a run of about 40 or 50 yards. When it is not practicable to construct an inclined plane, the target, by means of a rope, may be drawn across the open space between shelters.

368. The ordinary B target, the skirmish figure target (Target D), or the figure of a horse or deer, may be used. For either of the latter, the frame supporting the target should be so constructed that it can be revolved around a centre pin, so that the figure may not appear to be moving backward.

369. At the signal from the firing point one of the markers pushes the target into view with sufficient force to carry it down one inclined plane and up the

other to the opposite shelter, the soldier firing as often as accurate aim can be taken.

370. A dummy target should be painted on the butt adjacent to each shelter on which the shots can be marked, or if this cannot be done the running target, after each firing, sufficiently exposed to permit the marker to indicate the value and position of each hit. If no hits have been made, the marker will wave the red flag.

371. Firing at running targets should commence at 50 yards, to be afterward increased to 100 yards.

372. In firing at a moving object, whether it be a target, or a man walking, or a horse at a gallop, the soldier must remember that the object will pass over a certain distance between the moment when the aim is completed and the rifle is discharged and the time the bullet reaches it, and that this distance must be calculated and allowed for. To accomplish this, if the object be moving across his front, the soldier must carry his aim a little in advance of it, depending on the speed at which it is moving, on the distance which it is from him, and the resulting time required for the flight of the bullet. If the object is moving from him, he must fire high, and if approaching him, low; while these different allowances can be readily calculated, their application will only produce good results when they have been actually determined by the experience of the individual soldier.

373. In firing at an object moving across the line of fire, the soldier should first aim directly at it, and that the aim may be caught quickly and clearly, he should use a full sight and aim low. He then, without dwelling on the aim, moves the rifle laterally and

to the extent required, by simply turning on the hips, the arms and eye being kept steady and the shot fired the instant the aim is judged to be correct.

374. If the object is either approaching or receding from the soldier, aim should first be taken directly at it and then changed to in front of it or above it as much as may be required, according to its rate and direction of motion.

PART IV.

CHAPTER I.

TARGETS.

375. THE simplest method of determining the proficiency of the soldier at any time, is to divide the target into various divisions and to give to hits in these divisions a value, constant for all points in any one space, but increasing as the division lies nearer the central point of the target. This method gives a sufficiently accurate expression for the results of the soldier's firing.

376. As the targets used by the armies of different foreign nations are widely dissimilar, both in the shape and the number and size of their various divisions, it is not possible, even if it were considered desirable, to so arrange the targets for our service that any comparison can be instituted between the practice of our soldiers and those of more than any one foreign country. It therefore seems preferable to select the shape and proportions suggested by the natural variations of the arm, by the average degree and direction of the proficiency desired from and attainable by the soldier, and by the distances considered sufficient for his instruction.

377. The limited amount of ammunition and time available for practice have necessitated the selection of certain ranges for the soldier's instruction, and the

omission of others; and while for many reasons it would be preferable to adopt for each of the chosen distances its appropriate target, the additional complication and the added labor and expense that would result make it more desirable to employ the same target for at least two ranges.

378. For the short range practice at 200 and 300 yards, and for the instruction of the recruit at 100 yards, one target will therefore be used. For practice at the mid ranges, 500 and 600 yards, another target, and for the longer ranges, up to 1,000 yards, a third target.

379. The variations incident to the arm and ammunition cause a dispersement of the shots upon the target which is beyond the control of the firer and independent of the different meteorological and personal influences; as a consequence only a certain degree of accuracy is attainable in a succession of shots. It is therefore desirable to select such a shape and such dimensions for the bull's-eye, or division in which hits are given the greatest value, as will offset the natural dispersement due to the arm and offer to the expert shot an object which he may have a reasonable expectation of hitting.

380. To fulfil this condition the shape of the bull's-eye must be an ellipse, with its transverse axis vertical, since that is the form of every group consisting of a large number of shots, fired when all influences, except those due to the arm and ammunition, have as far as possible been eliminated. At the shorter ranges the relative difference between the two axes of the ellipse is slight, but this difference increases with the range. The normal shape of the shot

group, while offering a strong argument for the selection of a target having elliptical divisions, yet alone might be considered as not affording a conclusive reason for its adoption. It must, however, be remembered that, for the soldier, the true object of target instruction is not merely to enable him to hit a bull's-eye, or to make large scores, but rather to so educate him that his fire in action will be most effective; the target presented for his ordinary practice should then bear, at least in its general proportions, some slight resemblance to the figure of his enemy. A target with circular divisions fails completely to fulfil this condition, one with elliptical divisions (having the longer axis vertical) meets these requirements to a much greater extent, and moreover, what is of great importance, it teaches the soldier what it is so necessary he should learn, the greater relative value of accurate line shots. These various reasons all point irresistibly to the adoption of a target having elliptical divisions.

381. In determining the size of the bull's-eye for any range, its conjugate axis (or the width of the bull's-eye) should be at least equal to twice the horizontal component of the mean absolute deviation of the arm for that range (consult paragraphs 736, 737). While the rifle is the arm employed in practice by the majority of the troops, yet, as the mean absolute deviation of the carbine at the ranges where it will be used in target firing (100 to 600 yards) exceeds that of the rifle by about 50 per cent., the length of the conjugate axis determined for the rifle should be increased by that amount, in order that the target may be advantageously employed for troops armed with either weapon.

382. The proportional increase of the transverse over the conjugate axis of the bull's-eye, for any range, should be at least as great as that suggested by the dispersion of the shots at that range. But in determining its length, the effect of slightly changing the amount of front sight, taken in aiming, should not be disregarded. This variation in sighting is the one most generally made by the soldier, and is the most difficult to regulate ; it should not be placed in the same category as errors in judging the effect of the varying atmospheric conditions upon elevations or wind allowances, since these act both vertically and horizontally, but should rather be considered in determining the relative proportions of the bull's-eye. As its effect is more marked as the range is lengthened, the relative excess of the transverse over the conjugate axis of the bull's-eye should be greater in the mid range than in the short range target, and still greater in the long range target.

383. The results of firing several different rifles by the same man under similar atmospheric conditions also show an increase in the relative height of the shot group as compared with its breadth, and affords an additional reason for increasing, beyond the amount suggested by the vertical and horizontal deviation of a single arm, the relative excess of the transverse over the conjugate axis of the bull's-eye as the range is lengthened. This increase in vertical dispersion is due not only to ineradicable variations in the cartridge employed and in the construction of the rifle, but also to differences in their manner of treatment by the soldier. These different elongations of the bull's-eye are also necessary to bring it more in

harmony with the shape of the object offered for the soldiers' fire in battle ; in fact this latter reason is of itself sufficient, and would suggest such action even without any consideration of the reasons advanced in this and the preceding paragraph.

384. When a target is to be used for practice at more than one distance, in order that it should not be made too difficult for the longer range, the dimensions best adapted for that range should, as a rule, be the ones selected.

In the final determination of the different dimensions, fractions of an inch should be avoided as far as possible.

385. *Short Range Target* (Target A, Plate XVII., Fig. 1), used for 200 and 300 yards and in addition for such firing as may be held at 100 yards. At 300 yards twice the horizontal component of the mean absolute deviation of the rifle is 5.5 inches ; increasing this 50 per cent. that, as explained in paragraph 381, the target may be also adapted for carbine firing, and taking the result to the nearest whole number, gives 8 inches as the width of the bull's-eye. At this range the vertical exceeds the horizontal deviation by about 15 per cent. ; increasing this excess $\frac{1}{3}$ (the amount suggested by experience) in consequence of the variations caused by an ununiform employment of the front sight (paragraph 382), and also for the reasons advanced in paragraph 383, gives 25 per cent. as the proper excess of the transverse over the conjugate axis of the ellipse, or 10 inches as the height of the bull's-eye. The shape of the other divisions of the target should be similar to the bull's-eye, and for the centre or next division of the target, 24 inches wide

PLATE XVII.

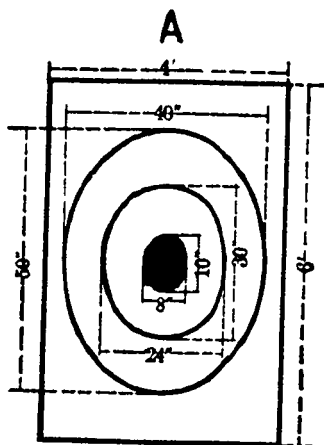


Fig. 1

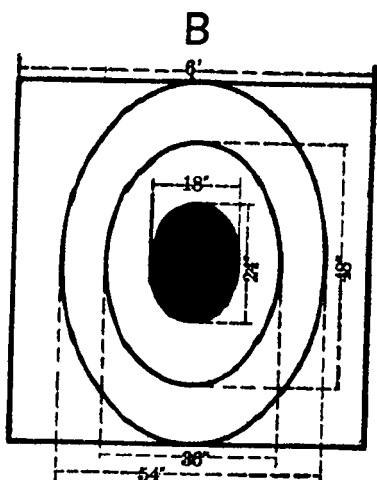


Fig. 2

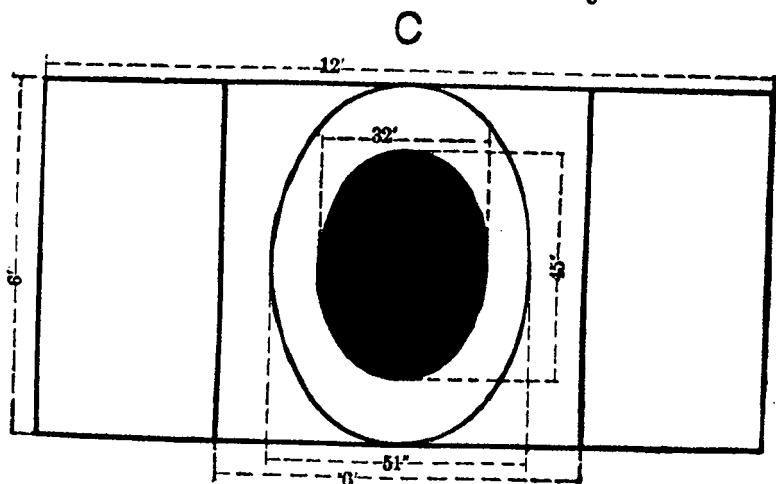


Fig. 3

and 30 high; for the next division, called the inner, 40 inches wide and 50 inches high. The outer or remainder of the target should be a rectangle 4 feet wide and 6 feet high.

386. *Mid Range Target* (Target B, Plate XVII., Fig. 2), used for 500 and 600 yards, and such practice as may be held at 400 yards.

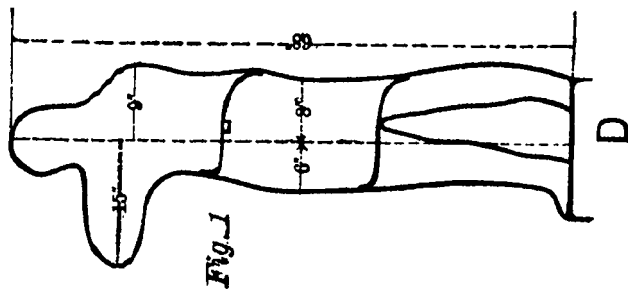
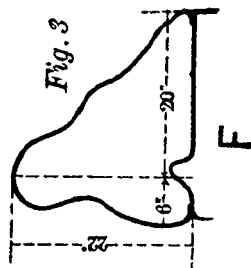
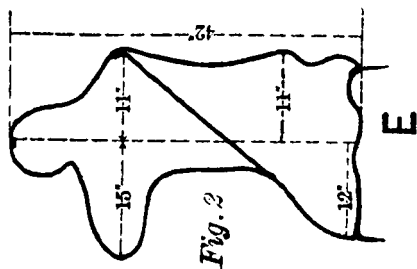
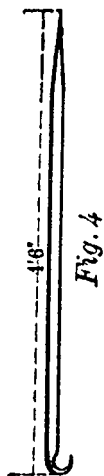
At 600 yards twice the horizontal component of the mean absolute deviation of the rifle is 12.2 inches; this increased 50 per cent. (paragraph 381), and the result taken to the nearest whole number, gives 18 inches as the width of the bull's-eye. At this range the vertical exceeds the horizontal deviation about 20 per cent., increasing thus $\frac{2}{3}$ for the same reasons as for the short range target (paragraphs 382, 383), and deducing therefrom, to the nearest whole number, the length of the transverse axis of the ellipse, gives 24 inches for the height of the bull's-eye. The corresponding dimensions for the other divisions would be centre $36'' \times 48''$, inner $54'' \times 72''$, and outer (the remainder of the target), a square $6' \times 6'$.

387. *Long Range Target* (Target C, Plate XVII., Fig. 3), used for all distances above 600 yards up to 1,000 yards.

Being used for four ranges the dimensions determined for 1,000 yards alone would not be the most appropriate. A better target will be obtained by considering the deviations at 900 yards.

At 900 yards twice the horizontal component of the mean absolute deviation of the rifle is 21.2 inches; this increased 50 per cent. and the result taken to the nearest whole number, gives 32 inches as the width of the bull's-eye. At this range the vertical exceeds the

PLATE XVIII.



horizontal deviation about 25 per cent.; increasing this $\frac{1}{4}$ for the same reasons as before (paragraphs 382, 383) and deducing to the nearest whole number the transverse axis of the ellipse, gives 45 inches for the height of the bull's-eye.

The centre should be an ellipse whose axes are 51 and 72 inches.

The inner a square 6' \times 6'.

The two outer spaces, one on either side of the inner, each 3' wide by 6' high.

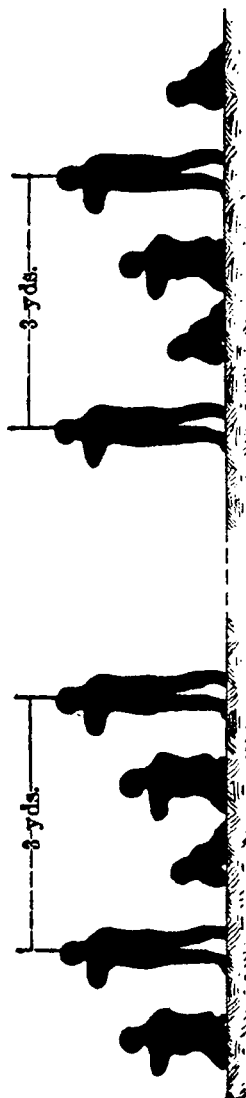
388. For all these targets the bull's-eye and the lines separating the different divisions should be black, the remainder of the target a very light buff.

The lines separating the centre and inner, and the inner and outer should not exceed $\frac{1}{4}$ inch in width.

389. *Skirmish Targets* (Targets D, E, F, Plate XVIII., Figs. 1, 2, and 3). These are iron skeleton frames, representing the outline of a soldier in the firing positions, standing, kneeling, and lying prone, and are retained in a vertical position by the points at the bottom of the frame, and by a sustaining rod (Fig. 4) which engages in a ring at the centre of the standing and at the top of the kneeling figure. When used as targets they are covered with cloth and with black paper, cut as silhouettes to the shape of the frames.

390. For the company practice as skirmishers the total number of these figures employed will be equal to the number of men firing; the target (G, Plate XIX.) will be formed by placing a kneeling figure on the right flank of the line of figures, followed by a standing and then a lying figure, and repeating this arrangement as often as necessary. The left flank of the line will then be occupied by a lying fig-

PLATE XIX.



TARGET G.

COMPANY SKIRMISH FIRING.



TARGET H.

COMPANY FILE FIRING.

ure when the number of men firing is exactly divisible by three; by a kneeling figure, when the remainder arising from this division is one; and by a standing figure when this remainder is two.

The standing figures will be placed 3 yards apart between centres, and the intermediate figures so that this interval shall be equally divided.

391. The targets for volley firing and for file firing will be composed as directed in paragraphs 349 and 356.

Target Frames.

392. The large first cost of iron target plates and the labor and expense required in forming a safe protection for the markers where they are used, generally limit their employment to posts having a large garrison and where a permanent occupation by troops is assured, and even in these cases the slowness of the practice, as compared with that where some form of revolving or sliding canvas targets are employed, and the difficulty in dark or damp weather experienced by the marker in distinguishing through the necessary plate-glass lookout the position of a hit, makes their use for military firing undesirable.

393. *Canvas Targets.* These targets possess the greatest advantages for ordinary use at the majority of military posts. They are made by stretching a light canvas or cloth over frames of the proper size, but of different material and construction, and then pasting on the cloth a paper on which the target, with its different divisions, has been printed. The bullet passing through the target thus prepared makes a sound easily recognized by the markers, and often heard at the

uring point, and leaves a hole which is covered by pasting over it a circular patch of black or white paper, according as the bull's-eye, or other part of the target has been struck.

394. *Temporary Frames.* When the garrison is very small, the occupancy of the post only temporary, as in the case of summer camps, or when a sufficient number of revolving or sliding targets cannot be obtained, wooden frames 6' \times 6' (for the short range and mid range targets) and 6' \times 12' (for the long range targets) should be made of pine or other light wood and permanently placed in the ground. To avoid as far as possible any glancing of the bullet, or the danger of lead spattering into the face of the marker, no nails should be used in the construction of the frame but the pieces made with mortices and tenons and fastened together with wedges or pins of hard wood.

395. To afford cover for the markers a pit should be dug in front of the target or a bullet-proof shelter constructed of earth or any available material, a little in front of the target, and that it may not throw a shadow on it, on the side opposite from the sun.

396. When firing is conducted at these targets, the position of the hit will be indicated by the marker with the marking staff and disk (Plate XX., Fig. 3) without leaving the shelter.

After five shots have been fired the marker, after displaying the danger signal and waiting until the signal cease firing has been sounded, or when no trumpeter is present waiting for a reasonable interval, will leave his shelter and cover the shot holes with the usual pasters.

397. At all military stations, except those temporarily occupied, some form of revolving or sliding target should be erected ; these enable the practice to be much more expeditiously conducted and with a greater certainty of security for the markers.

Different forms of these targets are employed ; the ones best adapted for army use are those devised by Colonel T. T. S. Laidley, of the Ordnance Department, that generally known as the Brinton Target, and that devised by Captain H. C. Cushing, of the 4th Artillery. Among other good forms of targets are those of General Geo. W. Wingate, formerly General Inspector of Rifle Practice of the State of New York, of Captain O. E. Michaelis, Ordnance Department, and a target used to some extent in the Military Department of Texas.

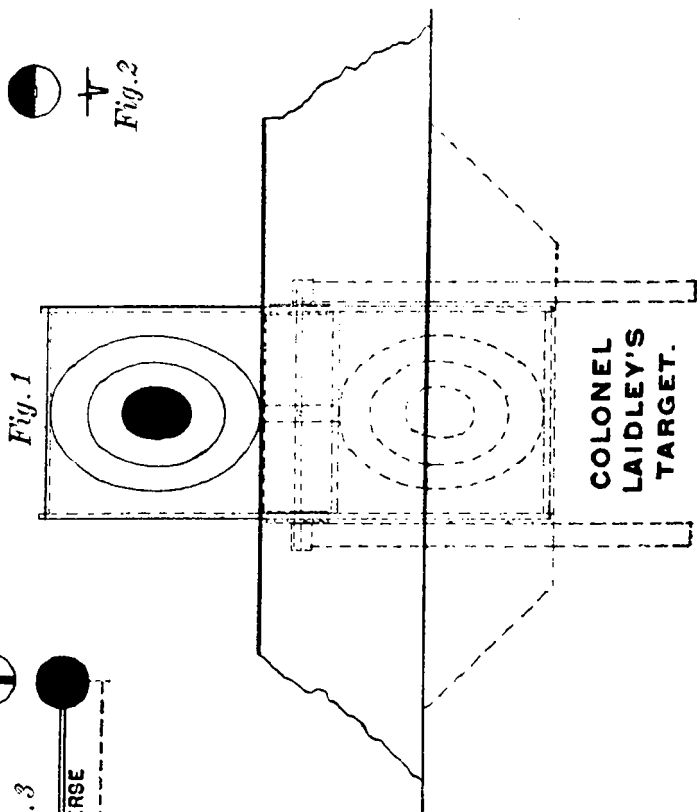
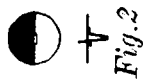
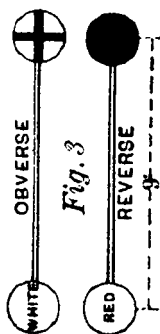
Revolving (Laidley) Targets.

(Plates XX., XXI., XXII.)

398. These belong to the class of revolving targets and are composed of two similar frames, each forming a target of the requisite size, securely joined to the opposite ends of two nave boxes and balanced on a common axle. The frames are made in preference of light wood, though iron of wedge-shaped cross-section may be used without making the target unwieldy from its weight. The parts of the wooden frame are joined by pins of hard wood, the use of metal nails or screws, or anything that might obstruct the passage of the ball, being carefully avoided. The frames are made of only two different sizes—6' × 6' and 6' × 12'.

399. The nave-boxes are made each of two pieces

PLATE XX.

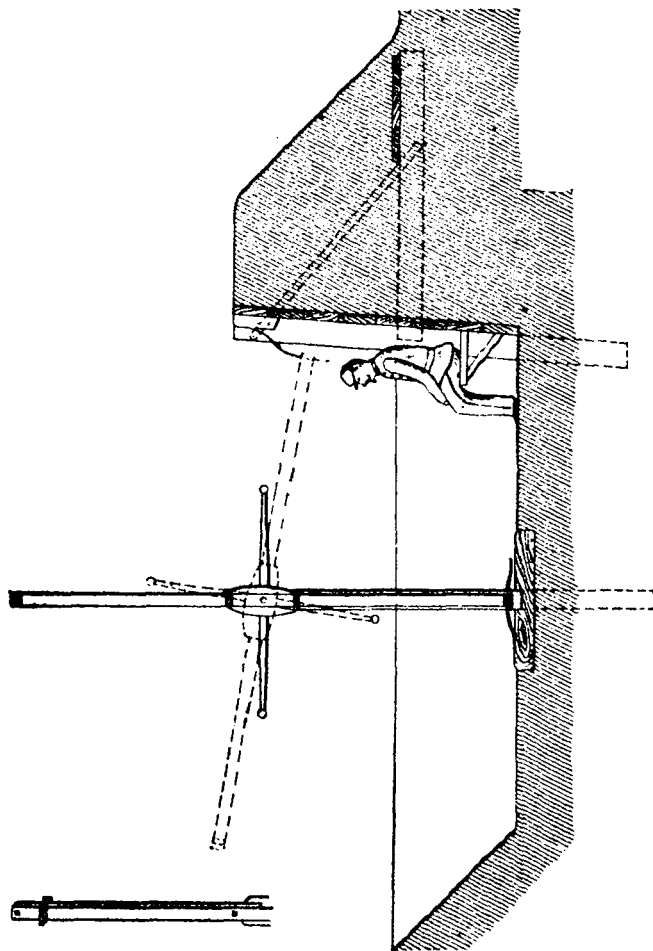


of pine 20" \times 5.75" \times 2.25" ploughed out and held together by 20 wooden pins, $\frac{1}{4}$ inch in diameter, and receive the ends of the target uprights, which are secured in place by wooden keys. The broad faces are bored to take a wooden axle 2.5" in diameter. The frames are made each of two uprights 4" \times 2" \times 86", which are mortised to receive the tenons of the two cross-pieces, 4" \times 2" \times 73.5" for the smaller, and 4" \times 2" \times 145.5" for the larger target; the cross-pieces are just 6 feet apart from outside to outside, the top one being 2" from the end of the upright; they are secured by wooden keys; the 12-foot target has diagonal braces at the corners of the frame to insure its stiffness.

400. White cotton cloth is stretched over the frame and tacked to it on the outside with small tacks, and a paper target of the size desired, on which the bull's-eye, centre, etc., are printed, is pasted on the cloth. Two pieces of hard wood, 24" \times 3.5" \times 2.5" with a mortise 1.5" square through the middle and a 2" rabbet on each end, are pinned securely at both ends to the lower cross-pieces at their middle point; two levers of hard wood 3 feet long, like a pickaxe handle, with a square tenon on the large end are fitted into this mortise, and secured by pins; they are used to turn the target; for the short and mid range target, 6' \times 6', these levers may, however, be advantageously omitted and the target turned by simply pushing on the upright adjacent to one of the markers.

401. Two journal-boxes, 6" \times 6" \times 4", made of hard wood and bored to receive a 2.5" axle, are placed over the ends of the axle preparatory to mounting the

Fig. 2



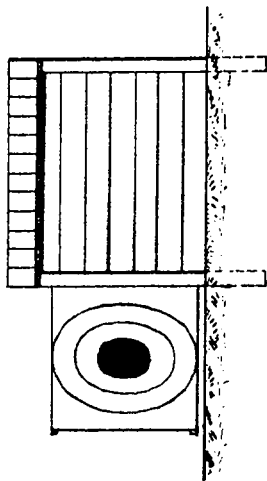
COLONEL LAIDLEY'S TARGET.

target and are pinned to the tops of the journal-posts. The journals might be formed in the tops of the journal-posts, but in that case the adjustment of the posts would require greater care to allow the target to revolve without binding in the journals.

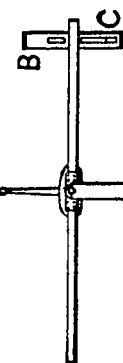
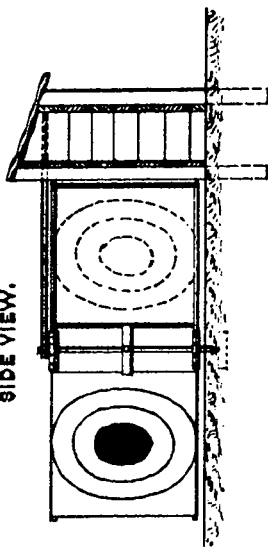
402. In constructing the shelter for the markers, the line selected for the targets should first be marked out, then parallel to it and 8 feet distant in the direction of the firing stand dig a trench 3 feet deep, in which dig holes for 7" \times 7" posts, 2 feet deep and 3.5 feet apart, set 10 feet posts, lay 2-inch plank between the posts and earth toward the firing stand, insert and pin the sills, or fasten them with spikes, secure the ties to the posts and sills, and lay 1.5-inch boards on the latter, as shown in Plate XXI. Widen the trench to 13.5 feet, throwing the earth on the flooring just mentioned, adding from time to time a 2-inch plank between the embankment and the posts to support the former. Ram the earth well, giving it a slope in front of 45°, and cover it with sod if convenient. The excavation on the side of the parapet is nearly vertical, and on the reverse has a slope of 1 on 1.

403. Set the journal-posts, 6" \times 6" \times 10 feet, 3 feet into the ground, with their front faces parallel to the plane of the breastwork and 7 feet from it, and ram gravel or small stones well around them, their upper ends being at the same height, and 73 inches and 145 inches apart, respectively, for the two sizes of targets. This is accomplished most conveniently by laying the posts down on the ground in their true positions, and connecting them by two boards nailed to both, one near the top and the other say 5 feet below,

ELEVATION.



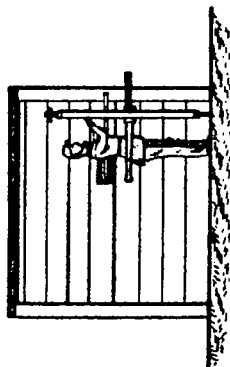
SIDE VIEW.



PLAN.

COLONEL LAIDLEY'S TARGET.

REAR ELEVATION.



parallel to the top, with a diagonal brace between them. Lay down a sill 6" x 6" x 48" and imbed it well in the ground in the middle of the space between each set of journal-posts; a mortise 8" x 2" x 2.5" is cut in the middle of the top face for the spring stop, which is made of hoop-iron bent to the proper form and nailed to the sill; it serves to stop and hold the target when it is brought into an upright position. Nail a spring stop to the post nearest the middle of the width of the target. This stop is used to hold the target in a nearly horizontal position when firing is not being conducted. When the target is in use this spring should be hooked down so as not to interfere with the target when it is revolved.

404. A shelter of boards or canvas secured to two arms hinged to the sides of two consecutive posts next to the edge of the target may be advantageously provided to protect the markers from the direct rays of the sun in case they become oppressive.

405. At posts where the ground is low and flat, and with no facilities for draining the shelter pit, the target may be placed on its side and made to revolve around a vertical axis, as shown in Plate XXII. The marker's shelter is formed of timbers of sufficient thickness to stop the balls, or the earth may be thrown up against it on the side toward the firing point. A block of wood is sunk in the ground to form the gudgeon-block. The upper end of the axis is held by a scantling having a hole of proper size, fastened at one end to the shelter, and at the other to a post set firmly into the ground.

A block of wood, B, is set into the ground, and holds a spring which secures the target in the firing position.

The pressure of the foot on the spring, C, releases it, and the target is turned so as to expose the other half to the firer, or it may be turned only 90° , in which case it is retained in position by the spring D. If the markers' shelter is given a length of about 18 feet, one of these targets can be placed at either end, sufficient intermediate space being afforded for their revolution and the labor and expense of preparing the shelter and range greatly reduced.

406. When practice is held at these targets, if a miss is made, the marker will so signal, without revolving the target. In case the target is hit the marker will indicate, with the staff and proper marking disk, the position of the shot hole, then revolve the target until its other half is brought to the firing position, and finally step behind the target and cover the shot hole with the proper paster. Two men can be advantageously employed for these duties.

The wooden staff, with a disk at each end, should be about 9' long and 1" by 1.5" in cross section; the disks, of sheet iron, for short range practice 10", and for mid range practice, 20" in diameter. For long range firing still larger disks 30" in diameter will be required if a signal glass is not employed, but as in some lights the unaided eye at this great distance can not always distinguish between the colors, the use of a glass and of the mid range disk is recommended.

407. When it is desired to indicate the position of the hit with greater accuracy than can be done with the staff and disk (Plate XX., Fig. 3), shot marks (Plate XX., Fig. 2) properly colored and about 3 inches in diameter (a size which requires a glass for their identification at the firing point) should be employed.

408. When shot marks are used firing is usually conducted on only one-half of the target, which when a hit is made is revolved but 90° , the proper mark caught into the shot hole, and the target turned back to the firing position. After the next hit, the target is again turned as before, the shot mark removed, that hole covered with a paster, and the proper shot mark placed over the last hit.

This method of marking will not permit as rapid firing as when the staff and disks are employed.

409. Firing can, however, be conducted when the shot marks are used and the target is revolved 180° . In this case the position of a hit is not shown until after the following shot has been fired; if the target is being used by a single soldier, this is a decided disadvantage; but if practice is conducted according to the usual plan, the men firing alternately in pairs, the marking will show each man's hit, just as he prepares to aim for the next shot and will therefore fulfil the required conditions.

410. The Laidley targets are very quickly manipulated, and the hit can be designated and the other half of the target exposed, as rapidly as two men aiming and firing carefully and deliberately ever desire to practise.

The target does not get out of order and when shot to pieces the uprights and cross-pieces can be replaced, spare parts being issued for that purpose. The axle-frame, if the marker's shelter is of the proper height will be very seldom struck.

411. No provision is made, however, for sheltering the cotton cloth and paper target from the weather, and rain or a high wind often destroy them, causing a

consumption of cotton cloth much in excess of the allowance; this can be obviated to a considerable degree by the improved methods of attaching the cloth by rings or strings (instead of tacks) to the target frames or by securing by wooden keys or buttons to the main frame a light temporary frame which can be quickly removed after firing and stored under shelter (Fig. 2, Plate XXI.).

412. The target is one of the cheapest in use, being made at an arsenal at a cost of \$17.18 for the 6' x 6' frame on a horizontal axis and \$15.65 for the vertical axis pattern of the same size; the 6' x 12' frame costs \$21.31.

The Sliding (Brinton) Target.

413. This target, first employed on the Brinton rifle range, near Elizabeth, N. J., has for issue to the army been considerably modified and improved by Lieutenant-Colonel D. W. Flagler, Ordnance Department. It now consists of three principal parts:

(a.) The timber frame support to carry the guide-rods.

(b.) The two carriages which slide on the guide-rods.

(c.) The two target frames (detachable from the carriages) to which the cotton cloth and paper targets are fastened.

414. *The Timber Frame Support* (Plate XXIII., Fig. 1; Plate XXIV., Fig. 1).

This consists of a sill, a top rail, two vertical side-pieces, and a horizontal and diagonal brace brought to the rear from each side-piece in planes perpendicular to the planes of the target; this frame can be

PLATE XXIII.

BRINTON TARGET.

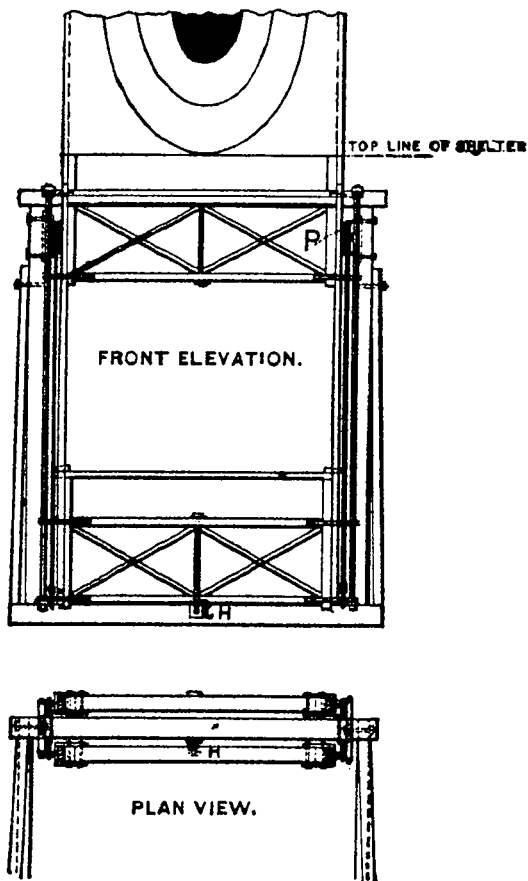
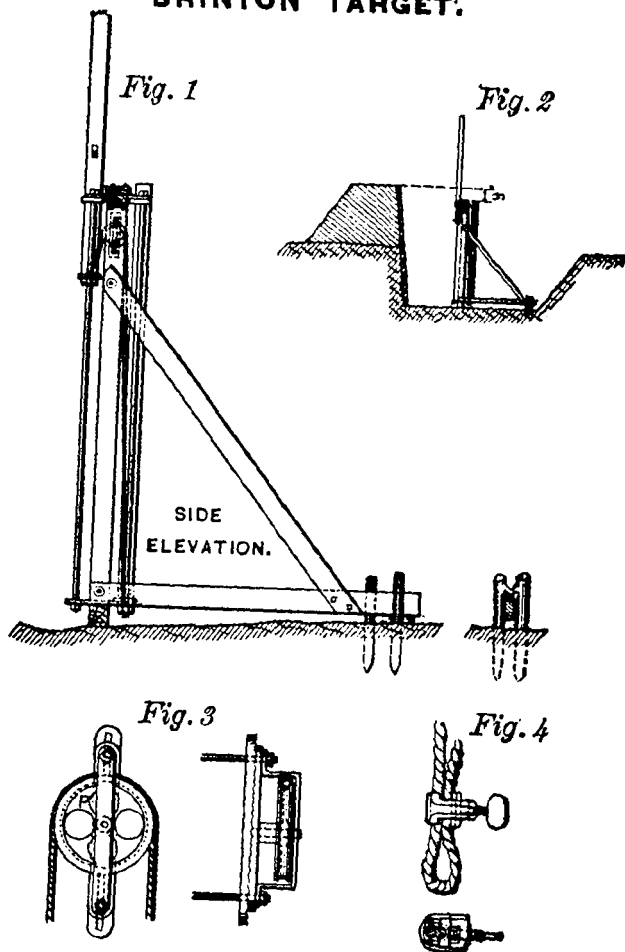


PLATE XXIV.

BRINTON TARGET.



readily set up and secured in any kind of pit and behind any kind of shelter. Two pairs of iron slide-rods (Plate XXIV., Fig. 1), one for the guides of each carriage, are so secured to the top rail and bottom sill that they can be readily removed. Near the top of each side-piece of the support is a pulley (Plate XXIV., Fig. 3), whose position admits of a slight vertical adjustment. Sash cord attached at each end to one of the carriages runs over this pulley and serves to raise one target to the position for firing as the other is withdrawn from view. The clamp (Plate XXIV., Fig. 4), by which the attachment of the sash cord is made permits of an easy adjustment of the vertical distance between the targets.

415. *The Carriage.* This never being exposed to bullets is made of clear pine, dressed and painted for greater durability; it is rigidly trussed to prevent springing and jamming in the slides and its different parts are interchangeable and so constructed that a broken piece can be readily taken out and replaced. For the 6' x 6' frame there is but one centre brace and four diagonal cross-pieces to each carriage; for the 6' x 12' frame, two more panels of the truss are added. To the top and bottom sill of the truss are secured iron guide rings, which move freely along the guide rods and serve to retain the target in position. A hook, *H* (Plate XXIII., Fig. 1), on the bottom timber of the support is provided for holding down the lower carriage when it is lightened by the removal of its target frame.

416. *The Target Frames.* These can be readily detached from the carriage, their parts are secured together by mortises and dowels, and fastened to the

carriage by the same means. The bottom piece of the frame is covered by the paper target, and should, therefore, be so placed, when the target is in the firing positions, that it can be seen by the soldier and hit by a low shot. The top piece of the carriage should be 9 inches below this piece of the target frame and covered by the marker's shelter. If so arranged neither the carriage nor any part of the timber support is exposed to fire.

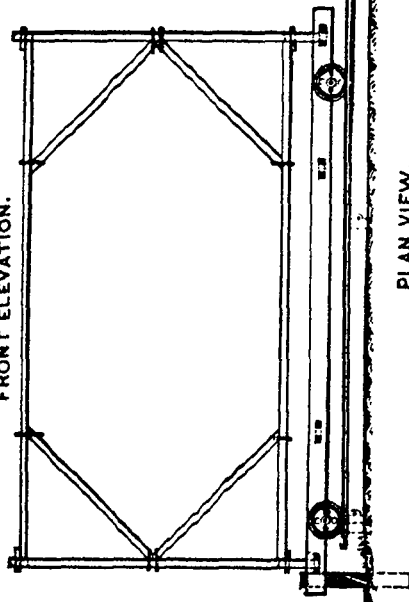
417. If the target, then, is properly set up, nothing but the target frame proper can be shattered by bullets; its parts, the side rails, the top and bottom rails, and (for the 6' x 12' frame) the braces, are issued as required and can readily be replaced by the soldier. The system possesses the advantage that by lowering the target half way from the firing position the two frames are brought close together, can be easily protected from rain by a single piece of canvas if so desired, and in this position are partly sheltered by the front of the pit: the target frames are also so easily removed, that they can be stored under shelter when not in use.

418. The system does not work well when a strong wind is blowing perpendicular to the face of the target, the upper frame, not always dropping as the lower frame is raised, a special effort being sometimes required to withdraw it from the firing position.

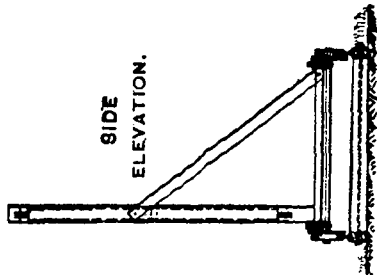
419. The target complete is also more expensive than either the Laidley or Cushing, the cost at an arsenal being \$40.08 for a mid range target, and \$48.43 for a long range target.

THE CUSHING TARGET.

FRONT ELEVATION.



SIDE
ELEVATION.



PLAN VIEW.

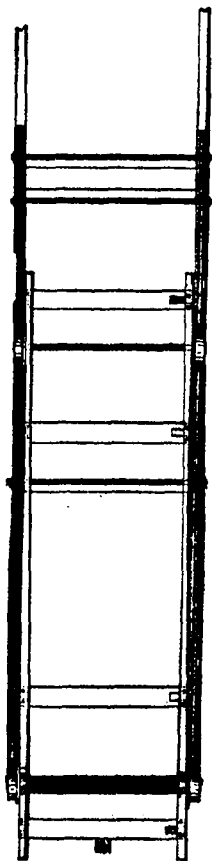
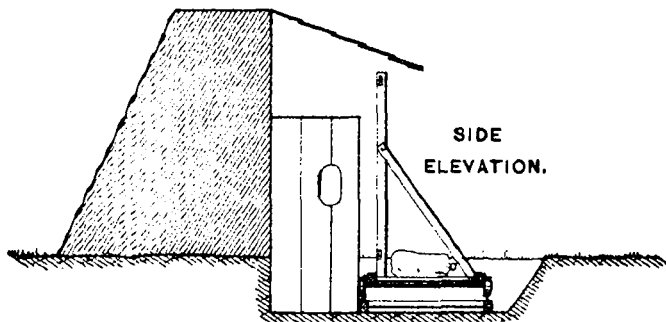


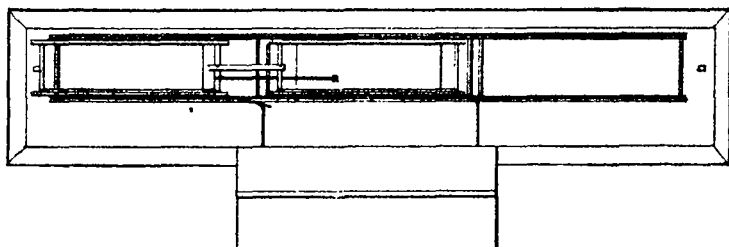
PLATE XXVI.

THE CUSHING TARGET.

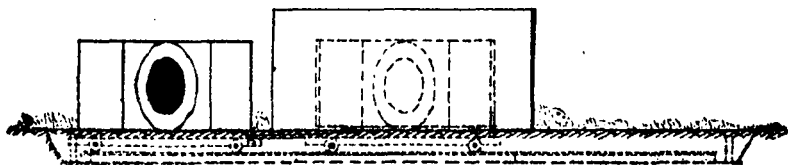
ARRANGEMENT OF TRACK AND MARKER'S SHELTER.



PLAN VIEW.



FRONT ELEVATION.



The Rolling (Cushing) Target.

420. This target, originally suggested by Captain H. C. Cushing, 4th Artillery, has, like the Brinton target, been modified in the details of its construction by Lieutenant-Colonel D. W. Flagler, Ordnance Department. The system consists of

a. A car (or two cars when the amount of firing renders a double target necessary).

b. The requisite amount of track.

c. A target frame for each car, these frames being either $6' \times 6'$ or $6' \times 12'$ as is desired, readily detachable and in all respects the same as the frames for the Brinton target, except that the side-rails are shortened at the bottom.

421. *The Car.* This is fully shown in Plates XXV. and XXVI. The frame is strongly made of seasoned clear pine, dressed and painted. The wheels are cast iron firmly fixed on a wrought-iron axle, in the same manner that railroad wheels are set on their axles. The bearings are cast-iron boxes fastened underneath the side-rails of the car and are oiled through a hole in the side-rail. The car is made long enough for a $6' \times 12'$ target frame, which stands in holes in the end cross-rails of the car. The $6' \times 6'$ frame stands in holes in the two middle cross-rails. The car is not heavy enough to withstand the pressure of a high wind without danger of overturning; this difficulty can be obviated if necessary by laying sand-bags on the cross-rails for ballast.

422. *The Track.* This is fully shown on Plates XXV. and XXVI. The frame is strongly made of seasoned clear pine, dressed and painted; the rail,

which weighs 8 pounds per yard, is firmly spiked to the frame and both ends supplied with fish plates for connecting together different lengths of track. Each piece of track is made 14 feet long, and complete weighs 165 pounds.

423. Whenever the ground will permit, the track should be sunk in a pit deep enough to protect it and the car, that is so that the top of the car will be 6 inches below the surface of the ground. When this cannot be done, a screen of the proper height should be constructed immediately in front of the track.

424. The arrangement of the track and markers' shelters for these targets is shown in Plate XXVI. If but one car is employed, the marking for firing at the long ranges will be slow; this can be obviated by the use of two cars. The car rolls so smoothly that it can be easily pushed from behind the shelter to the firing position; the run can be limited by a stake driven at the proper place in the ground, or by a rope having one end fastened to the car and the other to a cross-piece of the track; the elasticity of the rope giving less jar to the car in stopping, it should be used in preference to the stakes. The rope, or an extra piece of sash cord, if desired, also affords a means of withdrawing the car from the firing position; a prop at the end of the car can be employed to hold it in the firing position, if necessary. If the wind should be so strong as to blow the car either way too rapidly, its motion can be regulated in going out with the sash cord, or in coming in with the prop.

425. For extensive firing grounds for large posts, the markers' shelters for different targets can be placed on the same line, and a continuous length of track, ex-

tending the entire width of the range, employed. The target can then be readily used as a moving target, the car being drawn by a rope between contiguous shelters. If desired, the iron target frames employed for skirmish firing may be attached to the car for practice firing at moving figures.

426. An objection to this system, common to all rolling targets, to those revolving on a vertical axis, or any other plan in which the targets are placed behind a shelter and are all or nearly all above the natural level of the ground, instead of in a pit, is that the marker may sometimes expose himself beyond the end of the shelter. This disadvantage may be overcome by constructing end shelters placed perpendicular to, and one or two feet inward from, the end of the main shelter. These end shelters need only be pieces of plank nailed to a light frame; they also serve to protect the marker from wood splinters from the target, and also afford the necessary support for a light roof, which, if desired, may be constructed to shelter the markers and the target papers and different implements from the rain or sun. Holes in these end shelters permit the marker to use his shot-mark staff and the prop on the car. A further objection to the system is also found in the fact that, as generally placed, the markers' shelter will at some portion of the day cast a shadow on the target.

427. An advantage of the system, in addition to those formerly mentioned, is the ease with which the shattered parts of the target frame proper can be replaced, or the entire frame removed for storage or shelter.

428. The more moderate cost of the target as compared with the Brinton, is also in its favor, the cost of

two sections of track and of one car and frame being \$26.50.

429. For short range firing, a single car answers for two of the A targets; for practice at longer ranges the firing will be slow unless two cars are employed.

The Revolving (Wingate) Target.

430. This target (Plate XXVII.), devised by General George W. Wingate, formerly the General Inspector of Rifle Practice, National Guard, State of New York, and used at several army posts, as originally constructed or with minor modifications, belongs to the general class of targets revolving in a plane perpendicular to the plane of fire, and upon a horizontal axis, somewhat in the manner of a wheel upon its axle.

431. A piece of timber 12 inches square and about 10 feet long, is placed upright and sunk about 3 feet in the ground, so that its upper end is 6 inches below the top of the markers' shelter. The earth around the post should be well tamped, and if the soil is very yielding the post should be securely braced. This latter precaution will, however, be seldom necessary.

432. The target frames, which may be either 6' x 6' or 6' x 4', are constructed of light timber, and their different parts connected by mortises and wooden pins and wedges. The two targets are joined together by diagonal and vertical cross-pieces, and the entire frame-work then hung upon an iron bolt which passes through the post near the top and through an iron boxing in the centre of the cross-pieces. A nut at either end of the bolt permits the play to be so much diminished as to prevent wobbling. A spring or bolt

PLATE XXVII.

GENERAL WINGATE'S TARGET.

FRONT ELEVATION.

SIDE ELEVATION.

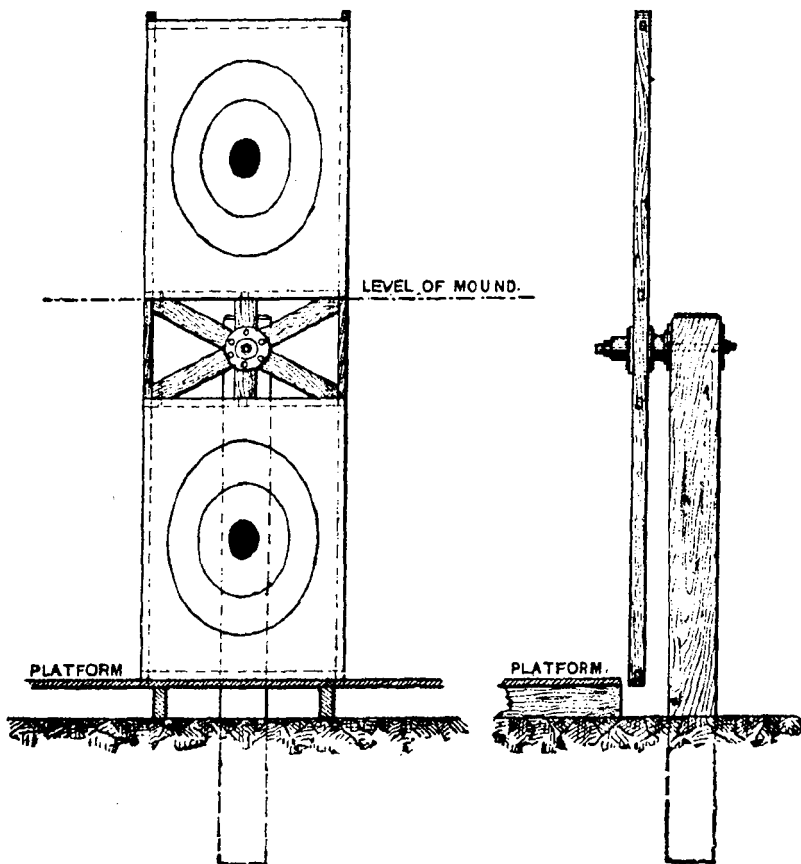
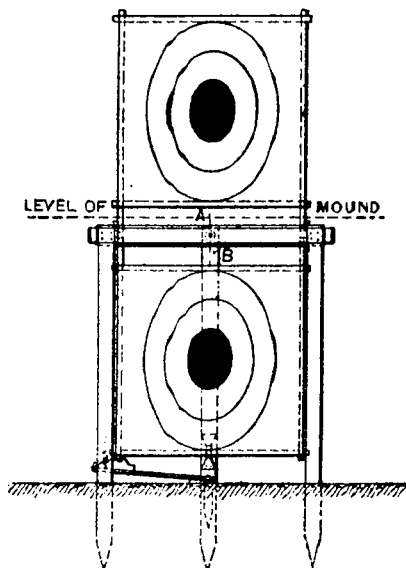


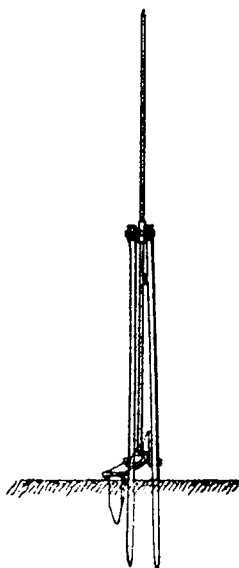
PLATE XXVIII.

THE TEXAS TARGET.

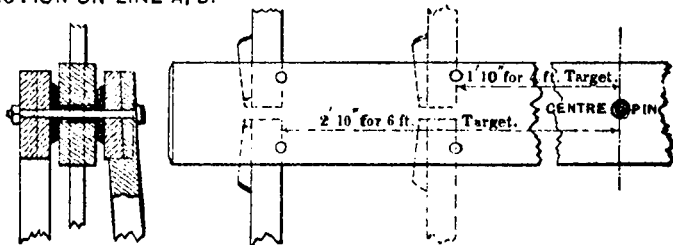
FRONT ELEVATION.



SIDE ELEVATION.



SECTION ON LINE A, B.



on the platform at the bottom of the markers' pit engages upon the bottom of the target, and serves to retain it in the firing position.

The Revolving (Texas) Target.

433. This is a modification of the Wingate target, which is used to some extent in the Department of Texas. The diagonal cross-pieces and uprights connecting the target frames in the Wingate target, are replaced (Plate XXVIII.) by a horizontal cross-piece 7 feet long, 7 inches wide, and $2\frac{1}{2}$ inches thick, in which mortises are cut for the reception of the vertical side-pieces of the target frame proper; these side-pieces are made 7 feet long and mortised 1 foot from the lower end, so that the bottom sill of each of the two frames shall be that distance from the main cross-piece of the target. This main cross-piece will then, by the markers' shelter, be entirely protected from bullets. The mortises for the reception of the uprights of the target frame proper, may be either 6 feet apart, for a frame for the B target, or if a separate frame is desired for the A target, they may be placed only 4 feet apart. The main cross-piece of the frame is bored out at its middle point for the reception of a short piece of $1\frac{1}{2}$ inch iron pipe, which is securely wedged in position. This pipe serves as a boxing for an iron bolt 7 inches long, which forms the axis of the target, and one end of which rests upon a post, as in the Wingate target, and the other upon a second post or upon a horizontal rail, connecting two other posts placed in front of the side-pieces of the target. Wooden washers placed on this axis keep the target from wobbling when it is revolved, the play being

increased or diminished by means of a nut working on one end of the bolt. A wooden buffer on the rear post near the bottom, presses the target against a spring which holds it in the position for firing.

434. The pit for both of the preceding targets can be made much narrower than for targets revolving in the plane of fire, and the labor required for their erection is correspondingly decreased. Sufficient room should always be left between the targets and the markers' shelter, to permit the markers looking at the upper target to readily detect a bullet hole and to easily indicate with the marking staff the position of the hit.

435. This Texas target shares with other varieties of revolving or sliding targets the advantages of affording safety to the markers, and of permitting great celerity in practice; it is, moreover, very inexpensive, and can, more readily than many other forms of targets, be constructed, if necessary, by the labor of troops alone, from the rough material available at military posts. Its use is therefore recommended to supplement the too often limited number of targets that the appropriations for such purposes will permit the Ordnance Department to supply.

Captain Michaelis's Target.

(Plates XXIX., XXX., XXXI.)

436. This is a double sliding target, so constructed that when one target is withdrawn to enable the marker to erase the bullet holes, the other is exposed in the firing position.

437. It consists of two similar frames, the top and

CAPTAIN MICHAELIS'S SLIDING TARGET.

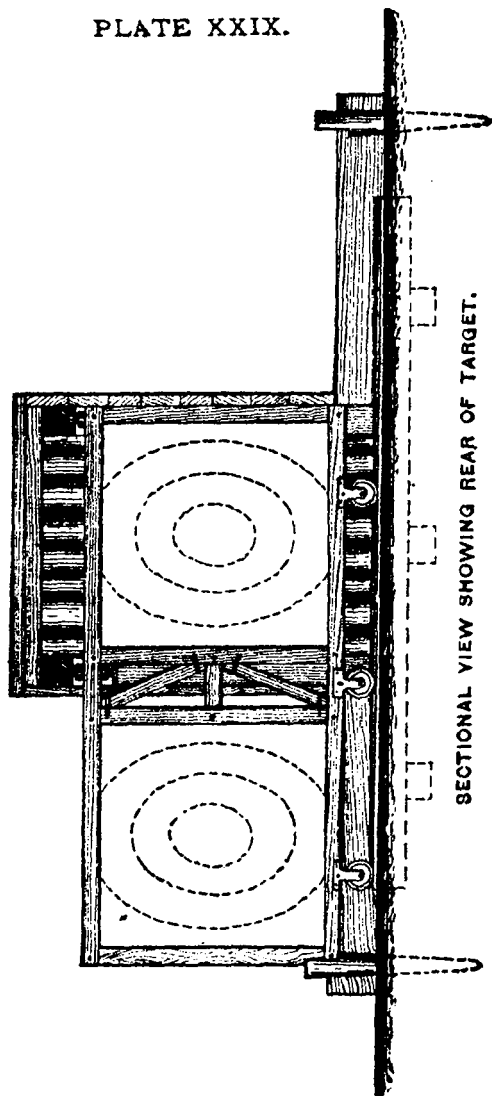


PLATE XXX.

CAPTAIN MICHAELIS'S SLIDING TARGET.

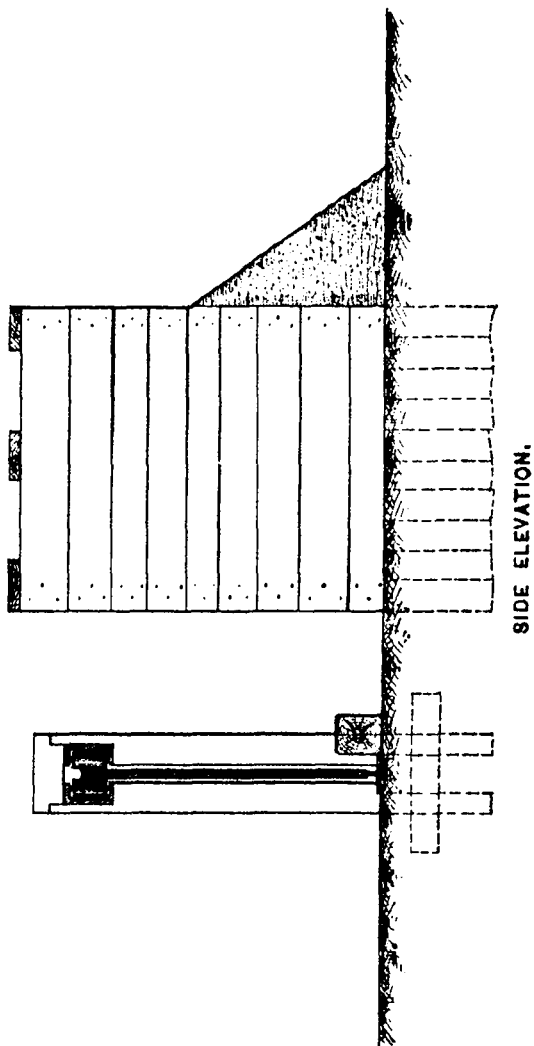
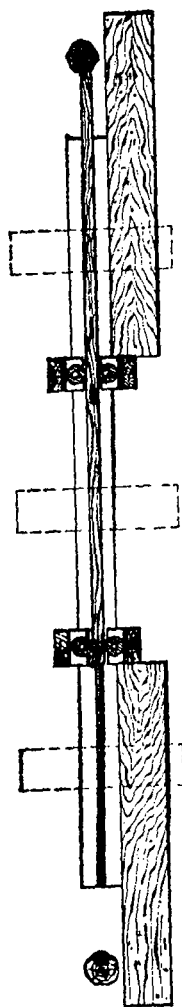
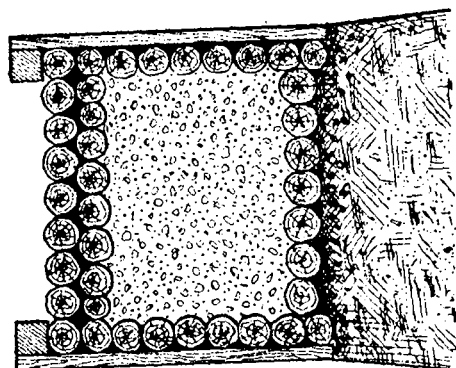


PLATE XXXI.



GROUND PLAN.



CAPTAIN MICHAELIS'S SLIDING TARGET.

bottom cross-pieces of each frame being in a single piece and joined to the four upright pieces by pins of hard wood. To increase the stiffness, diagonal cross-pieces are introduced between the adjacent uprights of the two targets.

438. Secured to the bottom chord of the target are three grooved rollers, running on a single track of round iron; the rollers and the track are protected from low shots, by a heavy square timber of sufficient size, or the track may be placed in a shallow trench.

439. The target is retained in an upright position by two pairs of vertical rollers, between which the upper chord of the target frame passes freely; these rollers are supported by upright posts, protected from bullets by the markers' shelter.

440. A short post at each end of the track limits the movement of the targets; these posts can be readily removed if it is desired to take out the target for repairs, or the same object can be accomplished by removing the caps on the roller posts.

441. The position of a hit on this target is indicated by the marking staff and disk, or by shot-marks, in the same manner as for the Laidley targets.

Disappearing Target.

442. A simple form of disappearing target is illustrated in Plate XXXII.

Six feet in rear of the markers' shelter is a post on which is hung, in the manner of a gate, a light wooden frame 6 feet high, whose parts are joined together by pins, and whose outer portion is by an intermediate upright reduced to 4 feet in width.

443. A cord (*a*) is secured to the bottom cross-piece

of the frame and passes through a pulley (*b*) fastened to a stake driven in the ground in rear of the position of the outer edge of the target when it is exposed; that the target may be operated by the marker without his stooping down, or without exposing the cord in front of the target to the chances of a hit, it should also pass through a second pulley (*c*) fastened at a convenient place in rear of the shelter.

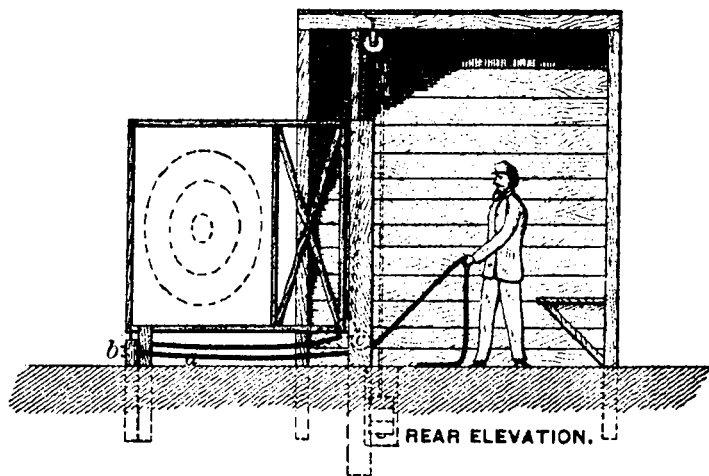
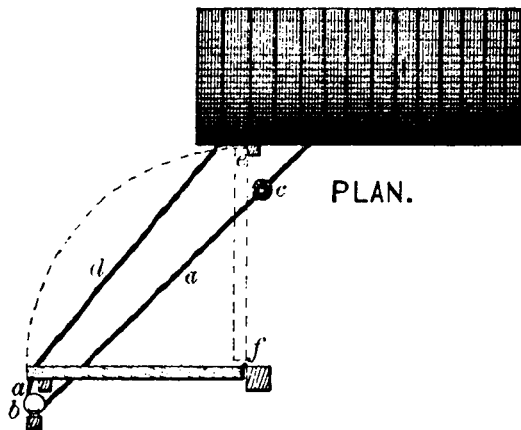
444. A second cord (*d*) should be attached to the frame near the first cord, and, passing through pulleys on the rear face of the butt, be finally attached to a counterbalance.

445. By means of the weight, the target is usually concealed (in the position "*ef*") from the firer by the markers' shelter. To operate the target, upon a given signal the marker pulls on the cord "*a*" until the target is brought into the firing position; the cord is held taut and the target retained against the post until the signal is repeated, when by releasing the cord the target is brought by the counterbalance sharply back to its first position.

446. If the target has been hit, shot marks are placed in the shot holes and the target for a moment exposed to view from the firing point.

447. During the practice season, one-half of a garrison will probably fire on one day, and the other half on the next day, or half during the first part, and the balance during the remainder of the week, and so on throughout the season, and if the method indicated in Chapter I. of Part II. is followed, each of these companies will be divided into several squads for practice at different ranges. That all may obtain the proper practice and yet the daily period be not unduly pro-

PLATE XXXII.



DISAPPEARING TARGET.

longed, it is requisite that at least two separate targets of 6' x 6' frame should be available for each company; this will require for a one-company post two targets, and for larger posts as many targets as there are companies in the garrison. In addition, long range targets should be supplied in the proportion of one for each three companies or fractional part of this unit. As the skeleton target frames for skirmish firing can be used by the companies in succession, no more will be required for large posts than for those garrisoned by a single company; all requirements will, therefore, be met by the issue to each post of twenty frames of each of the standing, kneeling, and lying figures. Where this number cannot be obtained, temporary wooden rectangular frames, to which cotton cloth can be attached and the paper silhouettes pasted, should be employed.

448. The cotton cloth for the target frame should be supplied in sufficient quantity to permit each target frame at the post to be re-covered twice a month during the practice season, and the frame of each figure target to be once covered. The paper targets, both for regular practice and skirmish firing, being comparatively inexpensive, should be supplied in sufficient quantity to permit a new one to be used, if so desired, for at least, every other practice.

CHAPTER II.

RANGES.

449. As the nature and extent of the ground available for target practice, and also the general climatic

conditions, are often widely dissimilar for different military posts, it will not be possible to prescribe any particular rules governing the selection of ranges, but only to express certain general conditions to which ranges should be made to conform as far as may be practicable.

450. For posts situated in thickly settled localities, where the extent of the military reservation is limited, the first condition to be fulfilled is that of security for those living or laboring near, or passing by the range; this requirement can be secured by selecting ground where a good natural butt is available, or by making an artificial butt sufficiently extensive to stop wild shots.

451. If no butt is employed, the tract of ground directly behind the targets should be unoccupied and not traversed by roads. This tract, at the targets, should be equal in width to the range, gradually broadening as the distance from the targets becomes greater; it should be about 1,500 or 1,800 yards in depth.

452. For complete security, there should be no road, building, or cultivated ground on either flank of the range, nearer than 300 yards.

453. The direction of the range with reference to the points of the compass should be determined, as far as practicable, from a consideration of the time most favorable for practice, the direction of the prevailing winds and the direction of the sun.

454. It is desirable that the range be so located that the wind will generally cross it at right angles, a condition more readily mastered in rifle-firing than a wind blowing either up or down the range. It is

also desirable (if the weather is generally favorable at that hour) to hold the practice in the morning, for then the soldier will not have been fatigued by the day's drill or labor. This latter condition, and the position of the sun, point to the selection of a ground where the targets can be to the north or west of the firing point; the soldier will then have the sun behind his back or at one side, and never in his eyes; and the light on the targets will be uniform and not broken by the shadow of the markers' shelters.

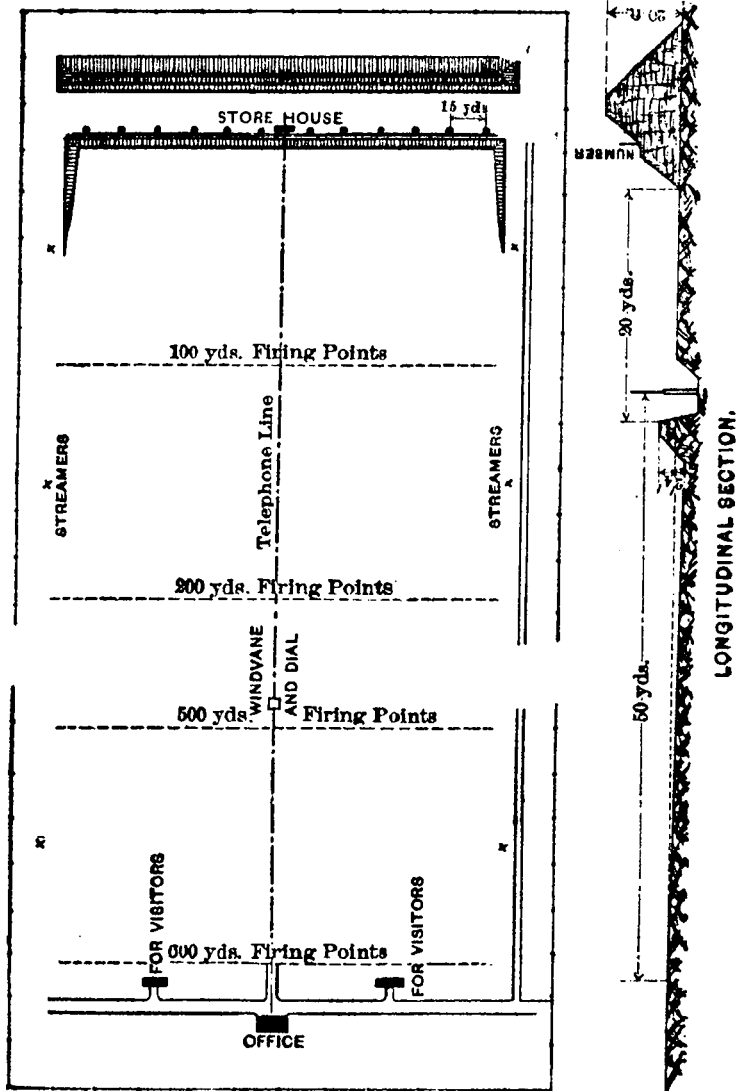
455. Smooth, level ground, or ground with only a very moderate slope, is best adapted for a range. If possible, the targets should be on the same level with the firer, or only slightly above him. Firing down hill should, if practicable, be avoided.

456. Final and important conditions require that the distance from the soldiers' barrack to the range should not be excessive, and that the range should be sufficiently extensive to permit firing up to at least 600 yards.

457. That the firing may, if desired, be brought under the direct supervision of a single officer, and to reduce to a minimum the amount of labor required in preparing the butt and ground, the targets should only be placed far enough apart to obviate the danger of a shot being fired on the wrong target. Fifteen yards between centres of targets will be found a good distance to fulfil this condition. (See Plate XXXIII.)

458. For targets which revolve on a horizontal axis or slide vertically, if placed with this interval, the markers' shelter should be continuous, extending also in front of the space between the targets; this will afford all the markers complete shelter, and will permit

PLATE XXXIII.



those at any target to be relieved or communicated with without compelling a cessation of any firing.

459. When targets sliding or revolving horizontally are employed, or where it is not practicable to make the markers' shelter continuous, the targets should be arranged in pairs, with intervals of 6 to 10 yards between the targets, and about 50 yards between the pairs. Or, if the breadth of the range is not limited, the targets should be arranged singly and about 50 yards apart; each special range will then be entirely independent of those adjacent.

460. The dimensions of the target pit will depend upon the kind of target employed; for a target revolving on a horizontal axis, or for one sliding vertically, the markers' shelter should be about half in embankment and half in excavation; this will have the great advantage of presenting in front of the target a low bank to stop that class of wild shots and prevent ricochets.

461. Where the shelter is constructed in this manner, it will, for all firing up to 600 yards, cover the ground for about 30 yards behind the targets; this then determines the maximum distance of the butt from the line of targets.

462. If an artificial butt is constructed, it should be made of earth, be not less than 20 feet in height (higher if practicable), nor have a more gradual slope than 45° ; this will compel a width, at the base, of about 15 yards. Nearly all the shots will bury in the lower portion of the butt, which from time to time will therefore require repairs. If the front slope is made in steps, the bullets can be dug out and the lead recovered without damaging the crest of the butt (see

Plate XXXIIL). The butt should extend, at the summit, about five yards beyond the outside targets; it should be sodded on top, and sown with grass on the slopes.

463. If the ground can be easily drained, or if the soil is such that the rainfall is quickly absorbed, it will be advantageous to take some of the earth for the butt from the ground in front of the markers' shelter, making the excavation about 3 feet deep at that point, with a gradual slope up to about 50 yards from the targets. This will still further prevent the possibility of ricochets.

464. For a natural hill to form an effectual butt, it should have a slope of not less than 45° ; if originally more gradual it should be cut into steps, the face of each step having that slope. For a temporary expedient the face of the hill might be plowed perpendicularly to the range, but as the bullets soon cut down the furrows, this measure must be frequently repeated to prevent the danger of ricochets.

465. Each target should be designated by a number; these, for ranges up to 600 yards in length, should not be less than 6 feet in height, and should be painted white on a black ground. The Arabic is preferable to the Roman notation, being more readily comprehended by the soldier; if made of the size suggested, they will always be quickly recognized, even in the haste and excitement of skirmish firing. They should be placed on the butt behind each target, but not so far above them as to prevent the soldier seeing the number when aiming at the target.

466. The range should be carefully measured and marked with stakes at each 100 yards, in front of each

target. The stakes should be about 12 inches above the ground, painted white and lettered in black, with the number of the corresponding target and its distance. These stakes will then designate the firing points for each target at the different distances. Particular care should be taken that each range thus marked out is perpendicular to the face of its own target.

467. If, on account of low ground, it becomes necessary to raise any firing point, a low mound of earth no higher than is absolutely required, should be made; the mound should be about 8 feet square and carefully smoothed and sodded.

468. The different ranges for the same distance should all be parallel, so that similar conditions with respect to wind and light may exist.

It is not essential, however, that the ranges employed for long distance shooting should be parallel to those used for the ordinary company practice at distances of 600 yards, or less.

469. For ranges used for only a few companies, a pole extending about 20 feet above ground should be erected at one side of the range, near the targets, one near the 300 yards and one near the 600 yards firing points, from which streamers should be flown to indicate the direction and, approximately, the strength of the wind.

470. For large military posts, where considerable firing is held and the range, therefore, of increased breadth, a second line of poles and streamers should also be placed on the opposite flank of the range; these will be required, as otherwise the soldier cannot, at the angle at which he sees the flags, correctly esti-

mate the direction of the wind with reference to the range. At ranges where the topography of the surrounding ground causes local eddies or currents, the poles and streamers should be placed every hundred yards, or at any other points where they may be particularly required. A wind vane and clock face by which the direction of the wind with reference to the axis of the range can be expressed, will also be found of considerable utility.

471. A pole and streamer should also be placed at the centre and top of the butt; this streamer, and those at the side of the range will then also serve as danger signals, to warn the surrounding inhabitants that firing is in progress.

472. A small house or shed should be built in the target pit in which the marking disks and signal flags and spare parts of the target frames for making immediate repairs, should be stored. It should be sufficiently large to afford a shelter for the markers in case of a sudden storm.

473. A socket for the staff of the danger signals should be placed on the markers' shelter in front of each target, and so inclined that the flag will always fall clear of the staff and be readily seen.

474. On large ranges where competitive firing is held, a house containing a store room and several office rooms should be erected in some central place, off the range but in its immediate vicinity. Such facilities as will enable visitors to satisfactorily witness the firing should also be provided.

475. Shelter trenches so constructed as to resemble such hasty intrenchments as troops would be able to throw up in battle, should be placed at convenient

points on the range and at 200, 300, 400, 500, and 600 yards from the targets, but not so as to interfere with the ordinary practice or the skirmish firing. The trenches should be about 12 feet long, half the length with a parapet 2 feet 6 inches, the remainder with one of 18 inches in height.

476. The men will be carefully practised in firing from these trenches either kneeling or lying down, and resting their rifles as they think best. Targets D, E, and F will be employed.

Range Officers.

477. At large military stations, where the range is provided with several targets and practice usually held simultaneously by two or more companies, and successively by others, a range officer should be appointed.

478. The range officer will be charged with the care and police of the range, and with the necessary repairs to the targets, shelters, butts, or firing points; in carrying out these duties he should be assisted by a non-commissioned officer and by the labor of such fatigue parties as may be required.

479. He will be responsible for the accurate measuring of the range and the correct location of the different firing points; that the targets are at all times free from any special marks that might afford undue assistance in aiming, and that the figure targets employed for skirmish, volley, and file firing, are correctly placed.

480. He will see that on the days selected for practice, the streamers are hoisted on the different poles and that the range is otherwise prepared for firing.

481. As the different companies or detachments arrive on the ground for practice, the range officer will assign them to targets. He will also designate the targets for each detail of markers (who should report to him at least 15 minutes before the hour set for practice), and see that they are provided with the necessary danger or signal flags, marking disks and pasters.

482. The range officer will not exercise any supervision over the details of the instruction of the companies practising on the range; he will, however, see that all necessary precautions are taken for the safety of those firing, and for the safety of the markers and any spectators that may be present. He will also observe whether the men in each company take, when firing, the proper positions for the different distances (that is, do not fire lying at the short ranges, or standing, etc., at the long ranges); and if any errors in this respect are made in any company, he will bring them to the attention of the officer directing that practice, and will report the facts to the post commander.

483. When ranges are not provided with butts and the surroundings are such that persons or animals might attempt to cross the ground in the rear of the targets, the range officer, before firing is begun, should post lookouts whose duty it will be to warn passers by that firing is in progress and to prevent any attempts to cross the line of fire. Whenever the lookouts cannot prevent the line of fire being crossed, they should caution the markers to withdraw the targets, and to display the danger signal until the ground is again clear.

CHAPTER III.

MARKING AND SCORING.

484. For the individual firing, the detail for marking for each target should consist of two privates, belonging to the company firing at that target; and one non-commissioned officer, *always selected from some other company*. The non-commissioned officer will be held responsible that order is kept in the target pit, and should be familiar with the regulations governing the markers, and with the method of marking. Commissioned officers should also be present in the target pit as much as possible.

485. Upon arriving at the proper target, the non-commissioned officer will see that the signal flag, marking staves and disks, and pasters are provided and in good order; and, if necessary, will notify the range officer of any deficiencies. He will then display the danger signal, and, examining the target carefully, will place pasters over any old shot holes, or put on a new paper target if necessary. When ready for firing, he will wave, and then take in, the danger signal and place the target in the firing position.

486. As each shot is fired, the non-commissioned officer indicates to one of the markers the value and position of the hit, if any is made, and supervises this marker while he signals (being careful to place the centre of the disk over the shot hole) the result of the shot to the firing point as follows :

If a bull's-eye, with a white disk.

If a centre, with a red disk.

If an inner, with a black and white disk.

If an outer, with a black disk.

If a ricochet, by moving the danger flag once or twice across the front of the target and just over the top of the markers' shelter.

If a miss, by waving the danger flag several times across the front of the target.

If the markers are certain on which side of the target the miss is made, the flag will also be waved to that side.

After the result of the shot has been signalled, the other marker, if a direct or a ricochet hit has been made, will reverse the target and place the proper paster over the shot hole.

487. Any shot cutting the edge of the bull's-eye will be signalled and recorded as a bull's-eye; and as the limiting line of each division of the target is the outer edge of the line separating it from the next exterior division, whenever this line is touched by the shot, it will be signalled and recorded as a hit in the higher division.

488. If it should become necessary before the completion of the firing for a marker to leave, or for other persons to enter, a target pit not provided with a continuous shelter and a covered approach, the target should first be turned or withdrawn from the firing position and the danger signal displayed. After the signal "Cease Firing," has been sounded, or, if there is no musician present at the firing point, after a few moments delay, the target pit may be entered or left; the target turned back to the firing position, the danger signal removed and firing resumed.

489. No persons besides the regularly detailed markers will be permitted in the target pit without

permission from the range officer, nor will the markers be changed without his knowledge and consent.

490. Upon the completion of the firing the non-commissioned officer will cause the target to be withdrawn from the firing position, and then make such a disposition of the danger signal and marking disks as may have been directed by the range officer.

He will also report to the range officer such repairs as that target, or its implements, may require for a succeeding practice.

491. The permanent record of the scores from which only the classification will be made, will be kept at each firing point by a non-commissioned officer. These scorers will report for that purpose to the range officer, and be assigned, if practicable, to a firing point where their own company is not practising.

492. The scorer, as each shot is signalled, will announce the name of the firer and the value of the shot; and will record it on the page of the company target record assigned to that soldier.

A bull's-eye will be scored 5; a centre, 4; an inner, 3; an outer, 2; a miss, 0; a ricochet will be scored R, and considered as zero in adding up the score. Upon the completion of each score he will announce the total made, repeating the name of the firer.

493. The officer directing the practice, and the soldier who is firing, will pay attention to the scores as announced and recorded, so that any error may be promptly investigated. The recorded value of any shot should not be changed after the succeeding shot has been fired.

494. All entries in the company target record will be made in ink, or with an indelible pencil; and no

corrections or alterations made except by the officer directing the practice, who will then append thereto his initials.

495. Where practice is conducted simultaneously on two or more targets by detachments of the same company, and it is impracticable for a single scorer to enter all the shots as signalled upon the company target record, the scorers at the other firing points will record the value of the shots in ink, or with an indelible pencil, in a book or memorandum sheet prepared for the purpose. This memorandum, upon the completion of the firing, will be copied into the company target record, under the supervision of one of the company officers.

496. When a post is garrisoned by a single company or where it is impossible to detail non-commissioned officers of other companies to supervise the marking and scoring, this duty should be performed by non-commissioned officers of the company firing. In this case new paper targets should be used for each firing, and upon its completion the company commander, or one of his lieutenants, should count the number of hits in each division of the target and compare the totals with the recorded scores. If the value of the hits as signalled is materially different from that obtained by the examination of the target, especially if the former record is much the greater, all scores as recorded for that day's firing will be cancelled and not considered in the soldiers' classification. Such corrective measures should also be taken as will insure accuracy on the part of the markers in future firings. As in some cases the markers may inadvertently make errors in signalling the hits, whenever an examination

of the target gives results very closely agreeing with the recorded scores, the record should be permitted to stand but the markers cautioned to exercise greater care in the future.

497. In the skirmish, volley, and file firing, it is not generally practicable to signal the results; and as only the number, and not the location, of the hits is considered, signalling is not essential. The scorer's record can then be dispensed with, and instead, a record of the hits kept in the target pit, which can afterward be copied by the officer conducting the practice directly upon the company target record.

If it is desired to know the results of each firing before continuing practice, the officer conducting the firing may be informed of this marker's record by telephone or messenger.

498. In the skirmish and volley firing there is danger that some pasters may be shaken off the targets by the impact of successive hits without its coming to the knowledge of the markers. In all cases therefore where any paper silhouette is to be used for a second firing a cross will be marked with a red pencil over each shot hole before covering it with a paster.

499. For the company skirmish firing, the examination of the targets and the record of the hits will be made by commissioned officers. The privates detailed to erase the shot marks may belong to the company firing, if not required to form part of the skirmish line.

That the marking may be quickly performed and the targets soon made ready for further firing, several officers should be detailed to examine the targets and

keep the record of hits; they can divide between them the examination of the different figure targets.

500. As the rivalry between companies might, in exceptional cases in the individual target practice, offer a temptation for incorrect marking and exaggerated scores, the officer conducting the practice will take the utmost pains to prevent such inaccuracies and to secure a correct record of the result of the firing. He should, in this endeavor, receive from the post commander every encouragement and assistance.

CHAPTER IV.

CLASSIFICATION.—RECORDS AND REPORTS.

Individual Classification.

501. THE class in firing to which any officer or man belongs will be determined from the aggregate of the total of all the scores composing the regular course of individual practice at known distances, as prescribed in paragraphs 217, 218 and 219, and the total of all the scores made in the regular individual skirmish practice, as prescribed in paragraphs 330, 332 and 333.

502. In the second season's course an aggregate of 1,000 for those firing with the rifle and of 900 for those firing with the carbine will be required for qualification as a sharpshooter.

For the marksman's class an aggregate of 720 will be required for those firing with the rifle and of 650 for those firing with the carbine.

For the first class an aggregate of 600 will be re-

quired for those firing with the rifle and of 550 for those firing with the carbine.

For the second class an aggregate of 460 will be required for those firing with the rifle and of 440 for those firing with the carbine.

In all subsequent seasons the aggregates required for qualification for the respective classes will be one-half of those above enumerated.

503. The third class will be composed of those (with the exceptions enumerated in paragraphs 505 and 506) who fail to make the aggregates qualifying them for the second class. A failure to complete their course, except for the reasons mentioned in paragraphs 505 and 506, will not exempt them from being included in the class where the aggregate they have made would properly place them.

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1873 504. All members of the company (with the exceptions noted in the following paragraph) who have been present at the station of the company at any time during the practice season and have not practised, will be classed as "present, but not firing."

505. The following will not be classified: Those lost to the company during the first month of the practice season by reason of promotion, death, discharge, transfer or desertion before they have completed their season's course of individual firing at known distances and as a skirmisher. But if discharged during the second month, unless excepted by the following paragraph, or if they have completed their course before leaving the company they will be classified according to the aggregates obtained.

506. The following will not be classified unless they have practised sufficiently to complete their season's

course of individual firing at known distances and as a skirmisher and have in such firing qualified for the marksman's class.

a. Those who have been absent from the station of the company for a period of one month or more, not necessarily continuously, of the practice season.

b. Those who if present have been prevented from firing during a period of one month or more, not necessarily continuously, of the practice season, in consequence of duty detaching them from the company (as a hospital attendant, the teacher of the post school, etc.), or in consequence of confinement under guard, or sickness of sufficient gravity to necessitate their being excused from all duty. 50,
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c. Recruits who have not been advanced to the regular individual skirmish practice as authorized by paragraph 330 will not be classified, but those who are advanced will be classified according to the aggregate of their scores upon the basis of the classification for the second season, as given in paragraph 502. (Consult also paragraph 352.) 50,
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507. If a soldier is transferred from one company to another, or is honorably discharged from one company and re-enlisted in another, his position in the first company will be determined by the application to his case of paragraph 505, and in the second company by the firing he may there do in accordance with paragraph 352.

In the case of officers changing from one company to another in consequence of transfer or promotion, these same paragraphs will govern.

508. At posts where the ranges will not permit of the course being conducted according to the prescribed

methods, the entire company, or if that is not practicable some of the best shots, will be sent to an adjoining post or into the field where their course can be completed. Those who receive the benefit of these advantages will be classed in the usual manner according to the aggregates of their scores ; the remainder of the company, if they have practised at all, will be in the third class, otherwise they will be classed as present not firing.

509. Upon the receipt at Department Headquarters of the monthly reports of sharpshooters and of the final classification of the company, a certificate of their qualification will be issued to each sharpshooter and to each marksman given in the reports, and also certain insignia indicating their skill in marksmanship, which will be worn as prescribed in the following paragraphs, provided however that marksman's certificates and insignia will not be issued to those qualifying as sharpshooters.

510. To the sharpshooter, a silver badge will be issued. For the year when qualification is first completed, the badge will consist of a pin and cross, and will be worn on the left breast ; the soldier having once qualified as a sharpshooter may continue to wear the badge even if qualification is not renewed in future years. To the soldier who has qualified as a sharpshooter for three years, not necessarily consecutive years, or in the case of enlisted men, not necessarily in the same enlistment, a silver bar will be issued, which will specify the years of qualification and will be attached to the badge between the pin and cross. For each additional three years of qualification an additional bar will be issued, and each in succession at-

tached below the one previously supplied and above the cross.

511. To the marksman, for the year when first qualifying, a pair of marksman's buttons, to be worn, one on either side and near the end of the coat collar; the buttons may be worn until the close of the target year next succeeding that for which they were issued, even if the marksman fails to qualify for the second year. If at the end of the second year the qualification as a marksman is not renewed the buttons will be removed, except in case of detached service or sickness during more than one month of the practice season, in which event the buttons may be worn, until, by his longer presence at the station of his company, the marksman has had the opportunity to renew his qualification in some future year.

512. A marksman renewing in an immediately succeeding year his qualification as such, will receive and wear on the coat collar a second pair of buttons.

The two pairs of buttons will then be worn together and removed together as prescribed in the preceding paragraph for the single pair of buttons last received.

513. To the marksman who qualified one year, failed in a second year (except for the causes mentioned in paragraph 511), but qualified for the third year, additional buttons will not be issued. He will be entitled to wear but one pair.

514. A marksman who has qualified for three or more years, not necessarily consecutive, or in the case of enlisted men not necessarily in the same enlistment, will receive a marksman's pin. The pin will be worn on the left breast, and will be retained and so worn by the marksman though he may fail to qualify

in succeeding years. Whenever the marksman's pin is worn, but one pair of buttons, indicating renewed qualification in the current or immediately preceding target year, will be worn ; if such qualification is not made, the pin alone will be worn.

515. These various insignia will become the property of the sharpshooter or marksman. If they are lost by the owner or in transmission to him, or if they become unsightly from long wear, they may be replaced without cost to the owner. But in all cases the official certificate of the company commander to the effect that he has investigated the circumstances of the loss and finds that no negligence can be imputed to the soldier will be required as evidence upon which to make new issues. Duplicates, if desired for use on separate coats, may also be sold to those entitled to wear the different insignia.

Figure of Merit.

516. By the device of the figure of merit a comparison of the standing in marksmanship of different organizations can be instituted and a conclusion drawn as to their probable relative efficiency in battle.

It is composed of the individual figure of merit, dependent upon the accuracy of fire of the individual soldier ; the collective figure of merit, showing the effect of the collective fire of the organization ; and the general figure of merit, the mean of the two partial figures, which serves as the basis for final judgment.

517. For the individual figure of merit all officers

and men (with the exceptions given in paragraphs 505 and 506) who have been borne on the rolls of the company at any time during the practice season will be classified and the computation then made by multiplying the number of sharpshooters by 200; the number of marksmen by 100; the number of first class men by 60; the number of second class men by 30; the number of third class men by 10; the number of "present but not firing" by 0, and dividing the sum of the products thus obtained by the total number in the above six classes.

518. The collective figure of merit will be obtained by adding to the percentage of hits for the regular course of company skirmish firing, the percentage for the regular course of company volley firing and then dividing the result by two.

519. The general figure of merit will be obtained by dividing by two the sum of the individual and collective figures of merit.

520. In determining the individual figure of merit of a regiment, the average of the results in its different companies will not be taken; but the total number in each class for the entire regiment multiplied by the proper multiplier and the computation similarly continued as in the case of a company.

In the same way the regimental collective figure of merit will not be determined from the average of the company figures, but computed independently, from the total number of shots fired and hits made in the skirmish and volley practice in all the companies (consult paragraph 554).

The general figure of merit of the regiment will then be the average of these two partial figures.

521. The general figure of merit of a post, of a department, or of the Army, will be obtained in a manner similar to that prescribed for a regiment.

522. The commissioned officers of a company will be included in computing its individual figure of merit.

Any other officers or enlisted men who though not required to attend target firing may yet have practised, will be included in the individual classification of the regiment (if belonging to the regimental field, staff, or band) and of the post or department to which they belong, but will not be considered with any company.

523. In computing the figure of merit of a department, or the departmental determination of the figure of merit of regiments, the records of such troops only as may be serving in the department for the last month of the practice season will be considered.

For the figure of merit of the Army and the final determination of the figure of merit of regiments, all the companies of a regiment will be considered, even if serving in separate departments.

Records.

524. The records are of two kinds, the company target record, and the soldier's target record.

525. **THE COMPANY TARGET RECORD.**—This is the official record of the individual firing in the regular practice at known distances and as skirmishers, and of the skirmish, volley and file firing of the company.

The preliminary firing forming part of the course will be entered as well as that from which the stand-

ing of the company, and of its members is determined, but the results of any "additional practice" will not be recorded. All entries will be made in ink or with an indelible pencil.

526. *Individual Known Distance Record*.—Two pages, opposite each other, will be assigned for the individual record of a soldier and will suffice for three seasons' practice. The scores for any range will be entered in the column set apart for that range and memorandum made as to whether they form part of the preliminary or regular course. At the conclusion of the regular practice at any range the total of the scores made for that firing will be recorded directly below the last score entered.

527. *Individual Skirmish Record*.—In this will be entered the date when the soldier has this practice, the number of hits made in each of the figure targets, with the corresponding score, and memorandum made as to whether the practice formed part of the preliminary or regular course. At the conclusion of the regular practice the totals for its results will be recorded directly below the last entries previously made.

528. *Company Skirmish Record*.—This will contain the record of the collective fire as skirmishers, each entry being preceded by a memorandum as to whether it forms part of the preliminary or regular course, and if the latter, whether it is the first, second, third or fourth manœuvring. Under the heading "strength available" will be entered the number of the enlisted men of the company (excepting the sergeants, musicians and those recruits who have not participated in the individual skirmish practice for record) who may be present at the post (consult paragraph 341). The

entries for the other columns are indicated by the respective headings. At the conclusion of the regular practice, the total number of shots fired with the total number of hits and the corresponding per cent. of possible score will be entered.

529. *Company Volley Record*.—This is the record of the preliminary and regular volley firing of the company. Each complete series of volleys will require three lines of the record, one for each range, and the distinction between the preliminary series and between the different series of the regular course will be observed in the manner indicated for the company skirmish record. The strength available, determined as directed in the preceding paragraph and paragraph 350, will be entered. At the conclusion of the regular series of volleys, the total number of shots fired with total number of hits and the corresponding per cent. of possible score will be computed and recorded.

530. *Record of File Firing*.—This practice forming no part of the regular course, no distinction can be drawn between additional, preliminary and regular practice, but the results of all the firing will be entered. The useful effect will be computed as explained in paragraph 359.

531. Six pages of the company target record are reserved for the record of the dates when the different men in the company were drilled in estimating distances. The true distances of the objects employed for the drill will also be entered.

532. **THE SOLDIER'S TARGET RECORD**.—This book will be retained as the property of the individual soldier. It will not form a part of the official records,

but should be so carefully kept as to afford him at all times the greatest possible benefit from his past experience, and enable him, from an examination of the record of previous firings, to form a reliable estimate of the different allowances best adapted to the varying conditions of any practice.

533. All scores made in each variety of known distance firing, should therefore be entered, and by means of the diagrams the exact position of each hit indicated. The nature of the weather—that is, dry, or damp, or raining, and whether cold, cool, warm or hot—should be recorded; with reference to the light, it should be noted as bright, cloudy, overcast, or dark, and if any mirage is noticeable, to what extent. Under the head of elevation should be entered that selected for the first shot, and as each change is made, the number of the corresponding shot and the corrected elevation, thus: π_{000}^1 , π_{100}^2 , π_{113}^3 , $\pi_{110}^{1.5}$, etc.

The direction of the wind, as 2 o'clock, 11 o'clock, etc., and whether light, strong, puffy, etc., should be recorded. The wind-gauge allowance and the changes made should also be noted in the same manner as for the elevation.

534. In this record should also appear the results of the soldier's individual skirmish practice, and his estimates of the different distances of objects employed in estimating distance drill; from the latter records he can determine whether he usually under or overestimates distances, and modify his future determinations accordingly. The kind of object whose distance is estimated, whether cavalry or infantry, a single man or a squad, and whether they are standing, kneeling, or lying down, should also be entered.

Reports.

535. **MONTHLY:** *Company Report of Progress in Target Firing.*—This report (Form 30-c) will be rendered at the close of the calendar month immediately preceding the opening of the practice season and at the close of each calendar month during that season. It will specify the number of preliminary exercises (sighting drills, position and aiming drills and gallery practices) that have been held during the month, the average number of men attending each, and the number not receiving this instruction; this part of the report particularly relating to the month preceding the range firing.

After the practice season has commenced, the report will give similar information with reference to range practice, giving the number that have completed each step of the course at known distance firing and those that have finished also their individual skirmish practice.

536. A summary of the individual classification and figure of merit for the practice season, as it appeared at the date of the report, will also be entered.

537. The progress in the course of collective firing will be reported, including therein the number of practices in company skirmish and volley firing. The number of times that the company has been exercised in firing by file will also be entered.

538. The certificate of all the company officers (see paragraph 561), with reference to the fairness of the practice and accuracy of the records and of this report, will be appended.

539. In case practice has been entirely omitted dur-

ing the month, the report will still be rendered, with reasons in full for omitting the prescribed instruction.

540. MONTHLY: *Company Report of Sharpshooters*.—On this report (Form 30-d), which will accompany the monthly report of the target firing of the company, will be entered the names of all officers and men who during the month complete their qualification as sharpshooters, with the total of each of their scores at each range for their regular course of known distance firing and the number of hits made in each of their regular practices on each of the figure targets with the corresponding scores.

The aggregate of all of these qualifying scores will also be entered. The years in which previous qualification was made will also be reported.

541. Sharpshooters reported in any month will not be included in this report for a succeeding month.

542. When in any month no officers or men qualify for this class, that fact will be noted on the company report of target firing (Form 30-c) and the report of sharpshooters (Form 30-d) will not be rendered.

543. These reports for each month will be submitted by the third of the succeeding month to the post commander, who, whenever any failures to conduct the required amount of practice are not fully accounted for, or whenever satisfactory progress has not been made, will promptly investigate the matter and note his action and the explanation rendered by the company commander on the report. The monthly reports of target firing will then be forwarded (not later if practicable than the fifth of the month) to the inspector of small arms practice of the department.

544. ANNUAL: *Company Report of Target Firing*.—

On this report (Form 30-b) will be entered the names of all officers and men who have been borne on the rolls of the company at any time during the practice season, with, for those who have practised, the total at each range for the scores comprising their regular course of known distance firing, and the total hits on each figure target for their regular course of skirmish practice. The particular course taken and the resulting classification will also be entered.

545. Opposite their names, in the body of the report will be noted all absences for a period of one month or more of the practice season, or the reasons for the failure of any present to practise; also the dates of the loss through discharge, desertion, etc., of any member of the company.

546. If any soldier fails to complete, at any range, his course of known distance firing his partial total for that range will not be entered. If his skirmish practice is not finished his incomplete record for that firing will be entirely omitted.

547. As some men will fire forty and others but twenty shots at each range, the average per cent. for the company can be most conveniently determined by taking one half the totals made by the former, adding the quotient to the totals made by the latter and dividing the result by the number of men firing at that range. The final figures, which will be carried to one place of decimals, will be the average per cent. desired and will be always entered on the report.

548. The record of the best single practice of the company in file firing, at each range where it is held, will be entered in the appropriate place.

549. The record of the regular course of com-

pany skirmish and volley firing will be entered. If the company skirmish firing has been omitted, the report will be made as if 90 per cent. of the average number available for firing (paragraph 341) during the last month of the practice season, had practised, firing 80 shots apiece, but making no hits; the figure of merit for skirmish firing will under these circumstances be zero. If this practice was omitted in consequence of the *impossibility* of obtaining a practicable firing ground, at or within a reasonable distance of the post, that fact will *also* be stated.

If the practice is held, but by the company not at the required strength, or if the course is not entirely completed, the number of shots actually fired will not be reported, but the number that would have been fired for the entire regular course by 90 per cent. of the average number available (paragraph 341) during the last month of the practice season. This hypothetical number of shots will then be considered in connection with the number of hits actually made in determining the figure of merit for skirmish firing. The fact that the computation is made in this manner will be noted on the report.

550. The result of each set of volleys (five shots per man), at each of the three ranges, for each of the four series comprising the regular practice, will be entered on the report.

If the firing is omitted, only partially completed, or held by the company not up to the required strength (paragraph 350) the number of shots that should have been fired will be entered, as required in the preceding paragraph, and the per cent. of possible score computed in a similar manner.

551. Within ten days after the close of the practice season, one copy of this report will be sent, through the post commander, to the headquarters of the regiment to which the company belongs (provided the regimental headquarters are in the same military department; if in a different department this copy of the report need not be sent), and one copy to the inspector of small arms practice of the department in which the company is serving.

552. ANNUAL: *Regimental Report of Target Firing.*—On this report (Form 30-a) will be entered for each company and for each range the number of officers and men (in a single total) who have completed their regular course at that range together with the average per cent. of the scores at each range for all those firing as taken from the annual company report. A similar record will be made of the firing of those of the regimental field, staff, or band who have practised.

553. The individual classification and figure of merit, and a summary of the results of the company skirmish and volley firing taken from the annual company report will be entered in the appropriate place, but no figure of merit will appear for the staff and band.

554. The total number practising at the different ranges, and the average per cent. of the scores, as given for the different companies, at each range, will be entered, and also the total for the regiment, of the number in each class and of the number of shots fired and hits made in the company skirmish and volley firing. When companies have omitted this latter practice or not held it with the required number of men, the number of shots ~~that~~ should have been fired (as

given on the annual company report) together with the number of hits actually made (which when the practice was omitted would of course be zero) will also be entered on the regimental report and considered in computing the per cent. of the regiment in skirmish and volley firing. The partial and general figures of merit will be computed according to directions in paragraphs 519, 520 and entered in the appropriate place.

555. As soon as practicable, after the receipt of the annual company reports, the annual regimental reports will be sent to the inspector of small arms practice of the department in which the regiment is serving.

556. *ANNUAL: Report of the Target Firing of the Troops in each Department.*—On this report (Form 30) will be copied the annual regimental reports. The various regimental totals and averages of each regiment for the previous year will also be entered, and the gain or loss of the current over the previous year noted in every case.

557. A summary will be made, giving the total for the department of the number in each class and also of the shots fired and hits made in the company skirmish and volley practice. The figure of merit for the department will be computed as prescribed in paragraph 521.

558. As soon as practicable, after the receipt of the annual regimental reports, the inspector of small arms practice will submit to the department commander the annual report of the department. The report will then be forwarded as soon as possible to the Adjutant-General of the Army.

559. At the close of the practice season, the range

officer at each post will make, through the post commander, to the department inspector of small arms practice a report with reference to the extent and adaptability of the target range for the different classes of firing, the number of targets on both the mid and long ranges and their pattern (Laidley, Brinton, etc.), whether they are in continuous or separate pits, with stop butts or not, the number of each of the iron skirmish targets, and the period of the year most suitable for individual and collective firing on the range.

A summary of these reports will accompany the annual report of the target practice of the department.

560. In addition to these reports the inspector of small arms practice of each department will, during the practice season, prepare for the information of the department commander and for publication in monthly orders, from the company monthly reports of target firing, the classification and figure of merit of the different posts in the department. A copy of this final determination for each post at the close of the practice season will accompany the annual report of the target firing of the troops in the department.

561. That the extent of the instruction and the relative proficiency of different commands may be accurately known and that the fairness of the methods adopted and the honesty of the records and of the reports may be established beyond any possibility of cavil, the following certificate will be appended to all company reports of classifications or of scores: "I certify that to the best of my knowledge and belief the course of regular practice, both individual and collective, has been conducted according to the re-

quirements of 'The Firing Regulations for Small Arms;' that the methods of marking and scoring there prescribed have been fully complied with, and that such additional precautions as seemed necessary to secure an honest record and correct report, based only on the results actually obtained, have also been taken, and that I am therefore fully assured that this report is entirely correct."

562. This certificate will be signed by all the officers who have been on duty with the company during the month, and will be accompanied by the indorsement of the post commander to the effect that he has examined into the methods of practice and of marking and scoring followed in the company and that he also believes the report to be correct.

PART V.

COMPETITIVE FIRING.

CHAPTER I.

PREPARATION FOR COMPETITIONS AND TEAM FIRING.

563. MATCHES between individual soldiers, and teams, representing the same and different organizations, are to be encouraged as much as possible. No pains should be spared by all officers to aid competitors in these matches, and in addition to securing the best individual shooting to develop teams which will produce the best results in shooting together, the emulation and experience obtained in matches being valuable in raising the standard of shooting, irrespective of the increased military efficiency obtained by the competitors.

564. In preparing for competitive shooting it is essential that the soldier should lead a regular life, without dissipation of any nature; that his diet should be simple, consisting mainly of meats, with as little farinaceous and vegetable food as possible; only a little coffee and tea should be drank, and the use of spirituous and fermented liquors, and of tobacco, whether in the form of chewing or smoking, only very moderately indulged in; radical changes of

habit in this respect should, however, not be made at or near the time of the competitions.

565. While great muscular development and endurance are not essential, yet strength and suppleness are very desirable. Therefore, while fatiguing exercise, particularly lifting heavy weights, must be avoided, brisk short walks of a mile or two, a few times daily, making occasional spurts so as to open the lungs and bring on perspiration, are very beneficial. After such exercise care should be taken not to catch cold.

566. Late hours not only impair the steadiness of the rifleman, but also unduly try the eyes; the soldier should therefore retire early.

567. While training, as much rest as possible should be given the eyes. No very great amount of firing, especially on very bright days, should be had, and but little reading or writing done; certainly none at all by lamp or candle light.

568. The soldier's practice should be mainly confined to the distances at which he will fire in competition. The best method of practice consists in firing every day, regardless of the nature of the weather, the same number of shots, and at the same ranges, as he will be required to fire in the match. He will find it advantageous to fire with other men under these conditions, endeavoring to excel the scores they may make; he should also accustom himself to firing in the presence of spectators.

569. The soldier should be careful that his dress, while loose and comfortable, yet in no manner impedes free and easy movement. It should be sufficient to preserve the proper warmth of the body,

better too much than not enough. A soft hat or cap will be the best covering for the head. If the conditions of the match require a waist-belt to be worn, it should be so arranged that while clasping loosely, it yet is not in the way.

570. At the time of the contest, and while waiting his turn to fire, the soldier should sit down and rest, paying but little attention to the firing and none whatever to the scores made by his competitors. He should avoid discussions or any conversation upon topics in which he is much interested; especial pains being taken to preserve a quiet and even temper and to avoid all worry and irritation from any cause. Any requests for indulgences or complaints with reference to errors or omissions incident to the conduction of the matches should be deferred until his firing for the day has been completed.

571. The soldier should, of course, while waiting his turn to fire, make his estimate of the effect of the deviating influences and adjust his sight accordingly, as explained in Chapter III., Part II.

572. After he has taken his place at the firing point, he should concentrate all his attention upon the work before him. If firing off-hand, he should after each shot give his arm all the rest possible by placing the butt of his rifle on the ground while waiting to fire; if there is the least interruption he should lay his rifle aside and cross his arms, or better yet rest sitting down. If any nervousness is felt, particularly if the legs tremble, the soldier should lay down his rifle and sit down for a moment.

If firing kneeling, he should either sit down or else rise to the standing position after each shot.

If firing lying down, the head, if a back position is taken, the rifle, if the prone position was chosen, should be permitted to rest on the ground after each shot.

573. No effort should be made by the soldier to keep the score or even to remember the number of shots fired. A similar ignorance as to the score of any one firing with him should also be maintained.

Team Practice.

574. The success of a team depends not merely upon the individual skill of its members, but also upon such organization and training as will secure concert of action and mutual assistance.

575. For this reason the team and its reserves should be selected as long before the match as possible; in choosing the men it must be remembered that steadiness and reliability *in the match* are all-important. A good average shot is therefore to be preferred to one who, while sometimes making a brilliant score, at others makes a poor one. Good habits are indispensable. Tried shots are to be preferred to inexperienced ones who have never shot in important matches, as a veteran is to be preferred in other parts of a soldier's duty. At the same time care must be observed to recognize skill and steadiness in new men.

576. The captain of the team should be a man of considerable decision of character, of an even temper, and without partiality or bias. He should be an experienced rifleman, a quick and accurate judge of the deviating influences, and have a thorough knowledge of the means to be taken to correct their effect. He should be able to inspire in the members of the

team a confidence in his judgment, in order that they may yield their personal opinions, without controversy, to his instruction, advice, and wishes.

577. As soon as the team is selected, the captain causes all the rifles to be carefully examined, and all deviation in the sights corrected.

578. This is best ascertained by firing at a small mark at a short distance. If any piece is found to be "off" in any way, and the defect is not cured by changing the rear sight, another rifle should be substituted if practicable.

579. The rifles having been thoroughly tested, the team captain makes a careful record of the elevation and allowance for wind required for each at the distances at which the match is to be shot. He then arranges the order in which the men shoot, which order is thereafter always adhered to. The first men to shoot are selected for their judgment in relation to wind and elevation, and the last are the most steady and reliable shots in the team. The latter should be men of good sight, as matches frequently last until so late in the afternoon that the last shots are fired when the darkness and smoke render it difficult to discern the target. When the men fire in different positions those using the same positions should be squadded together.

580. The practice of the team is conducted in precisely the same manner as the match.

581. The captain keeps a record of every detail, and as soon as the practice has proceeded sufficiently, calculates the difference between each man's shooting, and informs the team, so that each man knows what elevation upon the rifles used by his companions corresponds to his own.

582. If the exact difference between each man's rifle is known, and the men are steady, when one "gets on" the others should at once know the correct elevation and wind allowance, and in following each other every change of wind or weather causing a variation in the flight of the bullets is at once noticed, so that even if one man makes a bad shot, his successor will make a better.

583. No pains are spared to impress upon the men the necessity of concert of action and that the success of the team depends upon the weaker shots being prompted by the more expert, and any change in the wind or elevation at once communicated to those about to fire. For this purpose perfect frankness is indispensable, and all deviations caused by an imperfect "pull off" or aim in firing should be announced, as well as any alteration in the aim taken.

584. Each team should have a "spotter," who is provided with a field-glass, or, if practicable, a telescope. He has also a wooden target twelve inches square on which a miniature target is painted; this is placed on an iron rod two feet long when firing is to be held lying down, longer if the match requires other positions to be taken, having a foot-piece one foot from the end to force it into the ground. The target revolves on this rod.

585. The "spotter" habitually sits close to and on the right of the firing point, so as to be in easy view of the men firing. The miniature target is to his right, the rod being forced in the ground so as to bring the bottom of the target about the same height from the ground as the heads of the men firing.

586. He has two pins, both with colored heads, red

for the man who shoots first, blue for the second. When a shot is fired he turns the target toward him, and as soon as the shot is signalled he announces its value and position (as a centre at IX. o'clock, close in), inserts the proper pin in its exact position, and turns the target toward the firer. The competitors always watch the miniature target instead of the real one, both to avoid straining their eyes and because it is more exact.

587. The position of the captain of the team (except when the firing is "off-hand") is between the two men firing. He should keep the detailed score of each man in the manner suggested in the soldier's individual target record book, recording for each shot the exact point aimed at, as well as the point hit.

588. He personally examines each man's rifle before he fires his first shot, to be certain no mistake has been made in adjusting the sights; and when a sufficient allowance cannot be obtained on the wind-gauge, or when he considers it advisable to change the point of aim, rather than the allowance on the sights, directs him where to hold. When there are several targets adjoining he cautions him as he aims, "Fire on Target —," and, without disturbing him, glances along his rifle to be certain that his aim is not shifted to a wrong target. He watches carefully that the rear sight is not inclined; if it is, he cautions the firer to "Turn your barrel to the left;" "Correct" (when the sight is perpendicular.)

589. These cautions, as well as all other directions to the men firing, are to be given in a quiet manner, avoiding anything which will disturb their shooting. The same demeanor must be observed in the match

itself. Impatience or irritation will do more harm than good ; while a word of encouragement, given in a cool, deliberate manner, will do much to steady the nerves of a nervous man and prevent his " going to pieces."

590. The scores in an important match should be kept in duplicate by a representative of each team. A similar representative should be placed in the butts at each target as a check on the marker.

CHAPTER II.

DEPARTMENT, DIVISION, AND ARMY COMPETITIONS.

591. For the purpose of stimulating an honorable emulation among the men, of cultivating their individuality as marksmen, and to afford some experience in competitive firing, there will be held annually in each department a competition between selected soldiers, and also for each division a further competition between the representative riflemen from each of its departments.

The Department Competition.

592. For the first of these firings the competitors will be annually selected as follows :

a. The commanding officers of each battery or company will select from among the enlisted men of their commands the most suitable soldier, due regard being paid not only to the excellence of shooting, but to steadiness and good soldierly habits and conduct, and report the name of the man thus chosen to the post commander, who will send him to the place of competition on the date that may be fixed by the depart-

ment commander. If so desired, a competitor may also be selected in a similar manner from the regimental non-commissioned staff or band.

b. Each post commander will report to department headquarters the names of any commissioned officers among the expert shots (excluding the cavalry) in his command who may desire to enter the competition and whom he can recommend for that purpose; further stating, whenever more than one officer is recommended, the comparative proficiency, as rifle shots, of those reported. From these reports or from such additional reports of scores actually made, as the department commander may require, the department commander will select two officers as competitors from each regiment, except the cavalry, in his command, and in addition such officers from the different staff corps as he deems proper.

c. The department commander may also select as competitors enlisted men, not exceeding five in all, from the general service detachments or from the general staff of the Army.

593. The officers and men thus selected will assemble at some convenient post early in August of each year, and after such an amount and kind of preliminary practice (not exceeding three days in duration) as the department commander may prescribe, will compete for places on the department team of ten.

In this competition the firing will be at fixed targets at known distances, and also as skirmishers at undetermined distances, and the composition of the team determined by the aggregate of the scores for both classes of firing.

594. That part of the competition taking place at

known distances will extend over two days (not necessarily consecutive), ten shots being fired each day by each competitor at each of the ranges 200, 300, 500, and 600 yards. The firing at 200 yards being from a standing position; at 300 yards either kneeling or sitting, in both cases at Target A; and at 500 and 600 yards at Target B, at 500 yards from a prone position and at 600 yards from any lying down position authorized by the regulations for competitive firing.

595. That part of the competition embracing the skirmish firing will also extend over two days, not necessarily consecutive, one advance and retreat, as skirmishers, being made each morning and again one each afternoon, of each day, by each competitor. The firing will be at the group target (described in paragraph 329), the competitors, one assigned to each group target, being formed at a distance of 600 yards from the targets, and each having forty cartridges in his belt, with no additional cartridges about his person.

The firing in its various details will then be conducted as prescribed in paragraphs 326 and 327 except that the number of shots at each halt will be in the discretion of the competitor. If any cartridge fails to explode it will be replaced by the scorer with a new one. If a gun becomes disabled, the incomplete score will not be considered, but the competitor will repeat the advance, retreat and firing. Hits will be scored according to paragraph 334 under the restriction given in the latter part of paragraph 338. Five points will be deducted from a competitor's score for each of his failures to fire at least one shot at each halt, unless his forty cartridges have been previously expended; for each shot fired *before* the last

note of the signal "*Commence, FIRING,*" or *after* the last note of the signal "*Cease, FIRING.*" One half the sum of the morning and afternoon scores of each competitor will be recorded as his score for the day, half points which may arise in this division being deemed whole points, and so recorded.

596. The ten competitors who make for this four days' competition the highest aggregate scores will constitute the department team, and the two competitors making the next highest total scores will be added as alternates.

To the members of the department team thus selected the following prizes will be awarded: First prize, a gold medal; second prizes, a silver medal to each of the next three in order of merit of the team; third prizes, a bronze medal to each of the remaining six members of the team. These medals and such others as may be won in the other regular competitions or matches may be worn on all dress occasions. The winners will not part with them without authority from the Commanding General of the Army, but will preserve them subject for inspection at any time.

597. In assembling the competitors, no ordinary exigency of the service, field or other duty will be allowed to interfere with the representation of any company.

When sending competitors, or any details of markers or scorers, post commanders will forward to the place of competition the descriptive lists of all enlisted men.

The Division Competition.

598. The division commander will assemble the department teams at some convenient post in his divi-

sion, to compete, in the latter part of August or early in September, for the honor of places upon the division team of ten.

This competition, both as regards the duration of the preliminary practice and the competitive firing at known distances and as skirmishers, and the determination of the successful competitors, will be conducted in the manner prescribed for the department competition; the firing being *individual* by the collective members of all the teams, and not a contest of the teams as units against each other.

The alternates of the different teams will not fire in the division competition, unless required to replace members of their team who may be prevented by other duty or by sickness from competing.

599. To the members of the division team thus selected the following prizes will be awarded: First prize, a gold medal suitably inscribed; to the next three, suitably inscribed gold medals; and to the remaining six winning competitors, each a silver medal.

The Cavalry Competition.

600. Each year the Cavalry—two officers from each regiment and one enlisted man from each troop—will be assembled for competition at the times and posts that may be designated in orders from the Headquarters of the Army. There will generally be three of these competitions, one for the southern departments of the Division of the Missouri; one for the northern departments (including in the latter competition the cavalry of the Division of the Atlantic) and one for the Division of the Pacific, but the Commanding General of the Army will at any time make such

changes in these assignments as the particular distribution of the Cavalry may make advisable.

The competitions in the duration of the preliminary practice, the competitive firing at known distances and as skirmishers, the determination of the successful competitors, the prizes awarded and the general rules governing the contests will be similar to the division rifle competitions, except that the carbine will be used in the firing.

601. At these competitions the carbine firing will be supplemented by a revolver match in which all the competitors at the regular contest will participate, using the service Colt's or Smith & Wesson revolvers, with trigger pull not less than three pounds, and their service ammunition. The regulations (Part V., Chapter III.) for matches and competitive firing will govern as far as they are applicable, except that cleaning between distances will not be permitted.

The match will extend over two days, the firing the first day being dismounted and the second day mounted. For the former, for which there will be no preliminary practice, the distances will be 25 and 50 yards, ten shots at each distance, standing, off-hand, without rest or support of any nature for the pistol or pistol arm and at the A target; shots being scored according to the general rules for this target, and the result for the 20 shots expressed also by the per cent. of the maximum possible.

The mounted firing will be preceded by the amount of preliminary practice, with blank cartridges, not exceeding twenty for each competitor, that the officer in charge deems necessary to accustom the men to their horses, which for this match will be supplied from

among the most suitable cavalry horses at the post where the match may be held, and assigned to the competitors, officers and men, by lot. These assignments, when once made, will not be changed during the match or the practice preceding it and the troop commanders by whom they are furnished will so arrange that the horses shall always be available at the times designated by the officer in charge of the competition.

The match without preliminary practice with ball cartridges will then be continued as follows :

1st. With the competitors and D targets arranged as illustrated by the diagram in paragraph 848, one run, as prescribed in paragraph 851, will be made by each competitor firing five shots to the right and then by each competitor firing five shots to the left.

2d. With the competitors and targets arranged as directed in paragraph 853, each competitor will advance at a full gallop as there prescribed and fire five shots to the front; this latter firing will be repeated, each competitor again firing five shots to the front.

In the mounted firing all hits, whether direct or ricochet, will be scored one and the result expressed by the per cent. of possible score for the entire 20 shots.

602. The final order of merit for the revolver match will be determined by the mean of the per cents. obtained in the dismounted and mounted firing; and when thus arranged the following prizes will be awarded : First prize, a gold medal; second prizes, to the next three competitors in order of merit, each a silver medal; third prizes, to the next six competitors in order of merit, each a bronze medal.

The Army Competitions.

603. Every alternate year, the Army rifle team, composed of ten of the best rifle shots in the Army, will be assembled for competition at such convenient time and post as may be designated from Headquarters of the Army. The team will be selected in the following manner :

Each division commander will cause those of the class of "distinguished marksmen," who use the rifle in practice and who have not previously been members of the Army team, who desire to compete for a place upon it, to attend the division competition firing thereat, in the usual manner, during practice and competition, and the scores that they make in the latter firing being graded among those of all the competitors in order of their merit, though they cannot win a place on the division team. The officers and enlisted men highest on the resulting list, to the number that may have been designated in orders from the Headquarters of the Army, will form the quota from the division on the Army team, to which the next on the list will be added as alternate.

The competition of the Army rifle team, both as regards the duration of the preliminary practice and the competitive firing at known distances and as skirmishers, and the determination of the successful competitors, will be conducted in the manner prescribed for department competitions.

To the members of the Army rifle team in the order determined by their competition, the following prizes will be awarded : First prize, a gold medal ; second prizes, to the next three members of the team, gold

medals; third prizes, to the remaining members of the team, silver medals.

604. In a similar manner the Army carbine team of ten members will be formed in the same year, and the competition held at the same post, as that selected for the competition of the Army rifle team; "distinguished marksmen" of the Cavalry arm, who have not previously been members of either of the Army teams, who desire to compete for a place upon it, participating (for the same purpose as in the preceding paragraph) in that carbine competition which the division commander may select. The competition of the Army carbine team will be conducted simultaneously with and in the same manner as that of the Army rifle team, but for additional but similar prizes, which will be awarded as for the rifle competition.

No revolver match will be held in connection with this competition.

605. Whenever a marksman has been three times a member of a department team or has won any three of the authorized medals, he will be announced in orders from the Headquarters of the Army as belonging to a distinguished class, no longer eligible to enter the department or Cavalry competition, and an appropriate badge will be issued him.

"Distinguished marksmen" who have not previously been on the Army teams may, however, be selected once, but not a second time, as members of those teams. Every alternate year, alternating with the Army competition, ten of the best shots of the class of "distinguished marksmen" firing with the rifle will be selected in the manner that may be designated in orders, and assembled at some convenient

time and post to compete (after three days' preliminary practice) in the manner prescribed for Army competitions to determine their relative order of merit. The prizes for this competition will be a gold medal to the competitor making the highest aggregate score, and silver medals to the competitors making the second and third aggregate scores.

In a similar manner a team of "distinguished marksmen" of the Cavalry arm will be assembled with the team using the rifle, for competition and for prizes similar to those above prescribed.

CHAPTER III.

REGULATIONS FOR CONDUCTING MATCHES AND COMPETITIVE FIRING.

General Regulations.

606. This class of firing will be under the general control of an officer of experience, assisted by such range officers, statistical officers, and financial officers as may be required.

607. The officer in charge will prescribe the hours for any preliminary practice and for matches and competitions. He will also have general control of the range, and of its police and government during the firing.

608. The range officers will supervise, in the target pit, the marking, and at the firing point the scoring of the shots. They will also see that the competitors take in firing the prescribed positions, and that the squads at the different firing points preserve order and conform to the regulations of the range. One

range officer will generally be required in the target pit to every two or three targets, and on the range an equal number at the firing points.

During skirmish matches a range officer, mounted, should supervise the firing of each two or three of the competitors and a scorer will follow each competitor to keep record of the shots fired and prevent their being delivered at a wrong target.

609. The statistical officers will assign the competitors to targets, their determinations being generally made by lot, and to order or hour of firing. They will verify the additions of the scores as reported by the score-keepers, grade them in order of excellence, and prepare the results for official announcement.

610. The financial officer will have charge of all finances connected with the payment of money prizes or with the receipt of any entrance fees in matches or in bull's-eye shooting.

611. During the progress of a match or competition no one except the officers on duty at the range, the competitors and score-keepers, will be permitted within the ropes without special permission of the officer in charge.

612. The squads of competitors will be stationed five yards in rear of the firing point, where each competitor must remain until called by the score-keeper to take his position at the firing point and until he has completed his score.

613. All expressions on the part of the competitors of approbation or disappointment, with reference to any scores made by themselves or others, must not be uttered loud enough to be heard at the firing points.

614. Protests and objections must not be directly submitted to the officer in charge, but to one of the range officers. In case a competitor considers the decision of the latter unwarranted by the facts as presented, he may appeal to the officer in charge. Final appeals from decisions of the officer in charge must be made in writing and forwarded through that officer to the authority ordering the competition.

615. These regulations and such special rules or directions as the officer in charge may give, must be rigidly complied with by competitors and all other persons upon the range grounds.

Marking, Scoring, and Signalling.

616. Hits in the different divisions of the targets, misses and ricochets, will be signalled as prescribed in paragraph 486.

617. All shots fired by the soldier after he has taken his place at the firing point, and it is his turn to fire—the target being ready—will be considered in his score, even if his piece is not directed toward the target or is accidentally discharged.

618. Shots fired upon the wrong target will be entered upon the score of the man firing as a miss, no matter what the value of the hit upon the wrong target.

619. If two shots strike a target at the same, or nearly the same time, both will be signalled, and if a shot was just fired from the firing point assigned to that target, the hit having the highest of the two values signalled will be entered in the soldier's score and no record made of the other hit. A similar rule

will be applied when scoring hits in the competitive skirmish firing.

620. Before any miss is signalled the target must be withdrawn from the firing position and carefully examined by a range officer. Whenever the target is reversed and a miss then signalled, it will be presumed that this examination has been thoroughly made, and no challenge of the value signalled will be entertained or resignalling of the shot allowed.

621. The score-keepers will be seated close to and in rear of the firing point stakes, and will, as each shot is signalled, announce the name of the competitor and the value of the shot, and, at the conclusion of the score of each competitor, repeat his name and total score.

622. Competitors must pay attention to the score as announced and recorded, so that any error may be promptly investigated. The recorded value of any shot will not be changed after the following shot has been fired, unless some special message with reference to it is received from one of the range officers in the target pit.

623. Any alteration of a scoring card must be witnessed by the officer in charge of the firing point and indorsed with his initials.

624. At all meetings where a number of men engage in the same matches or competitive firing, the labor of the statistical officers will be greatly lightened, and the prompt announcement of the score facilitated, by giving to each competitor a number by which he is known throughout the firing.

625. Whenever the same squad of men fire together at several ranges and on several different days

(as in the preliminary practice preceding department and division competitions), it will then be found convenient to prepare a score-book, containing on a single left-hand page the names of the men, grouped in pairs, with their company and rank ; and on several right-hand pages (so arranged that they can in succession be readily torn off and transmitted to the statistical officers) the number of each of the men as assigned them by the statistical officers, and blank spaces for the detailed and total score of each. (See Appendix D, page 352.)

626. When men fire in different squads and at different targets, it is advisable to give to each competitor a score-card stating his target and order of firing, and containing a blank space for the record of shots fired, and for the signature of the scorer. (See Appendix D, page 354.)

627. These score-cards should be printed on card-board, using different colors for different ranges ; but for all kinds of firing, whether bull's-eye shooting, matches, or competitions, employing the same color for the same distance, as, for instance : all score-cards for 200 yards, yellow ; for 300 yards, red ; for 500 yards, blue ; for 600 yards, white, etc. This rule will prevent such a mistake as a competitor shooting on a 300 yards score-card, with its particular assignment of target, at 200 yards, as the score-keeper quickly becomes familiar with the color corresponding to each distance.

628. As scores are completed, an officer or non-commissioned officer detailed for that purpose should, without waiting for all the firing to cease, collect the records of the scorers and transmit them to the statis-

tical officers, who will enter them in the permanent record, and their totals upon the bulletin-sheets prepared for that purpose.

629. In skirmish firing, after the competitors have returned to the 600 yards firing points, and the signal "Cease FIRING" has been sounded and repeated twice, the markers will examine the targets and signal the total hits upon each. Or the results of the firing may be communicated by telephone, or better by means of prepared score-cards, by mounted orderlies. In this firing the precautions mentioned in paragraph 498 will always be observed.

Rifles and Ammunition.

630. In the authorized competitions officers and men will use the rifle or carbine, as issued by the Ordnance Department, as may be determined by the application of paragraph 177.

631. The aiming notch or the aperture of the rear sight slide may be slightly widened or opened to accommodate individual peculiarities of eyesight, but no other alterations or filing of the regular service sights, or the use of detachable spirit-levels, or of temporary shades for the sights, will be permitted. The front or rear sights may, however, be whitened, blackened, or colored, according to the judgment of the soldier. The use in aiming of orthoptic eye-pieces, will not be allowed nor will any marking or coloring with the purpose of making the graduations of the sight more distinct be permitted.

632. The trigger-pull must always be at least six pounds, and will be tested (holding the barrel vertically) by each competitor, under the supervision of a

range officer, or scorer, before firing, each day and at each range.

633. Competitors will submit their rifles for further inspection whenever required.

634. Unless the use of other ammunition is distinctly authorized, the ammunition used will be the service cartridge for the arm, as manufactured and issued by the Ordnance Department. No reloaded or especially manufactured cartridges will be employed.

Positions and Targets.

635. At 100 and 200 yards, Target A, firing off-hand. Any standing position authorized in paragraph 225.

636. At 300 yards Target A; at 400 yards Target B; in both cases firing kneeling or sitting. Any position authorized in paragraph 232.

637. At 500 and 600 yards Target B, and at longer distances Target C; in both cases firing lying down. Prone at 500 yards, at longer ranges any position authorized in paragraph 238.

638. Whenever at any of these distances a competitor desires to take a position not alluded to in the foregoing paragraphs, the officer in charge will decide whether it shall be permitted, remembering in making his ruling that the spirit of these regulations allows in the choice of positions for firing at the different ranges as much latitude as is compatible with the preservation of a broad distinction between the three general classes of positions.

639. For skirmish firing in matches or competitions the group of figure targets will be used, and the soldier permitted to take for firing, at each halt, any position that he desires.

Shooting.

640. Competitors will wear their prescribed fatigue uniform with belt. The use of a campaign or other hat or cap may, however, be permitted instead of the forage cap, in the discretion of the officer in charge.

641. In competitions or matches embracing more than one distance, the firing will commence at the shortest distance, and be followed in order by each of the longer distances, the firing at the longest range being held last. Sheds or shelters for the soldier will not be permitted at any range. Competitors must be present at the firing points punctually at the time or in the order stated on their score-cards; no application on the part of a competitor for any alteration in his assignment will be entertained.

642. In all practice and competitions the competitors will place themselves at the firing points by twos, and will fire alternately, the odd number of each pair being on the right, and firing first.

643. If just as a shot is fired the target is withdrawn from the firing position (the match not being at moving targets), the scorer at that firing point will at once report the fact to one of the range officers, who, if upon investigation he is satisfied that the case is as represented, will direct that the shot fired be not considered and that the soldier fire another shot.

644. Competitors will not be hurried in their firing, but such slight delay permitted after each shot as they may desire; provided the time of firing the score does not exceed an average of one minute per shot.

645. If an accident to a target, or any other cause

over which the soldier has no control, prevents him completing his score within a reasonable interval, he will be permitted such additional time as a range officer may decide.

646. No two competitors shall shoot in any match or competition with the same rifle ; nor shall a competitor change his rifle during any competition, unless his first rifle has become unserviceable through an accident, which must be verified by a range officer. Wilful but not unintentional violation of this regulation will warrant the officer in charge, in his discretion, excluding the soldier from further competition.

647. No sighting shots, nor any warming or fouling shots, will be allowed in any match or competition.

648. Rifles can only be cleaned upon the completion of a score. In competitions at more than one distance, cleaning will be permitted between distances. While, with these restrictions, cleaning will be permitted, it will not be required.

649. Except in team matches, no "coaching" or unnecessary communication of any kind with those actually firing will be permitted.

650. In team matches, the presence at the firing point will be permitted of one team captain and one coach or spotter for each team, who may give to the members of their teams such directions or advice as they think proper.

Ties.

651. Ties will be decided as follows :

A. In individual shooting, at known distances.

1. When the firing takes place at more than one distance, by the total score made at the longest

distance ; and if still a tie, and there be three or more distances in the competition, by the total score at the second distance, and so on for each of the successive distances.

2. By the fewest misses in the entire score.
 3. By the fewest outers in the entire score.
 4. By the fewest inners in the entire score.
 5. If still a tie, by inverse order of shots, counting singly from the last to the first.
 6. By firing single shots at the longest range.
- B.* In team shooting, at known distances.
1. By the aggregate of the total scores made at the different distances in inverse order.
 2. By the fewest misses in the entire score.
 3. By the fewest outers in the entire score.
 4. By the fewest inners in the entire score.
 5. By the totals, for the team, of the final shot of each competitor.
 6. By the totals, for the team, of these successive closing shots, in inverse order.
 7. By the competitor on each side who has made the highest score firing five rounds at the longest distance.
- C.* In individual skirmish firing.
1. By the greatest number of penalties imposed.
 2. By the greatest number of hits.
 3. By the fewest hits in standing figures.
 4. By the fewest hits in kneeling figures.
 5. If still a tie, by repeating for one complete advance and retreat the skirmish firing.
- D.* In team skirmish firing.
1. By the greatest number of penalties imposed for the entire team.

2. By the greatest number of hits in the entire score.
3. By the fewest hits in standing figures in the entire score.
4. By the fewest hits in kneeling figures in the entire score.
5. If still a tie, by the competitor on each side who has made the highest score firing through one complete advance and retreat as a skirmisher.

E. In matches or competitions, combining (as in the department, division, and Army competitions) firing at known distances, and as skirmishers, ties in the aggregate score will be decided by giving precedence to the competitor having the best total score in the skirmish firing. If the scores in the skirmish firing are also of the same total, the order of merit for that firing (and therefore the final order of merit) will be determined in accordance with clause *C* of this paragraph except where the tie was occasioned by the addition of a half point as authorized in the latter part of paragraph 595, when precedence will be given the score not receiving this increment.

652 The names of competitors who have to shoot off ties will be posted on the bulletin board as soon after each match as practicable.

Bull's-eye Firing.

653. Bull's-eye targets will be open at such times as may be practicable in the intervals between matches or competitions.

654. For this firing the soldier may purchase tickets

(at a price determined by the officer in charge—preferably ten cents a ticket), each ticket entitling him to one shot at a bull's-eye target at such a distance (within the conditions offered for firing) as he may select. If, while firing the number of shots to which he is entitled, he makes a bull's-eye, he will receive from the scorer a ticket stating that fact.

655. At the close of the firing each evening, so much of the receipts as corresponds to the number of shots fired that day, at each distance, less such a percentage as it is desired to retain as a remuneration for the markers or scorers, will, on presentation of their tickets, be divided *pro rata* among those making bull's-eyes.

The total receipts from the sale of tickets, at each range, does not enter into the computation determining the value of the bull's-eye tickets; for, if the firing is held on more than one day, some of the tickets bought on any one day may be retained, and the corresponding shots fired on some other day.

656. No person will be allowed to fire more than five shots consecutively, at any bull's-eye target, provided others are waiting to fire.

Penalties.

657. Any competitor who shall be detected in an evasion of the conditions prescribed for any match or competition shall be excluded from further participation in the firing at that meeting.

658. Any competitor,

a. Who shall fire in a name other than his own, or who shall fire twice for the same prize, unless per-

mitted by the conditions of the competition to do so ; or,

b. Who shall be guilty of falsifying his score, or being accessory thereto ; or,

c. Who shall offer a bribe of any kind to a scorer or marker, shall, upon the occurrence being proved to the satisfaction of the range officers and the officer in charge, be reported, in writing, to the officer ordering the competition, who will then direct that the competitor be forever disqualified from taking part in future contests ordered by his authority.

659. Any competitor refusing to obey the instructions of the officer in charge, or his assistants, or violating any of these regulations, or being guilty of unruly or disorderly conduct, or being intoxicated, will be immediately debarred from further competition at that meeting. The officer in charge will also report the facts in the case to the officer ordering the competition, who will take such further action as he deems proper.

660. Any person, whether a competitor or not, interfering with any of the firing squads, or annoying them in any way, will be warned to desist, and if he repeats the offence, will be at once ordered off the range grounds.

661. Competitors and all others connected with the meetings of military riflemen must make themselves acquainted with the foregoing regulations, as well as with the conditions of any match or competitive firing in which they may be participating, as the plea of ignorance of either of them will not be entertained.

PART VI.

THEORETICAL PRINCIPLES.

CHAPTER I.

MOTION OF BULLETS.

662. WHEN a rifle is discharged the bullet is acted upon by several forces, viz. : by the projectile force, by the force of gravity, and by the resistance of the air. The effect of these forces is also modified by other minor forces which influence, often irregularly, the flight of the bullet.

The Projectile Force.

663. The explosion of the cartridge gives rise, by the decomposition of the gunpowder, to a large amount of gas, which, being highly elastic, endeavors to occupy a space much greater than that in which the powder was contained, and consequently exerts considerable pressure in every direction.

The pressure upon the sides of the barrel only sets up vibrations in the metal ; that in the direction of the breech induces the recoil, which in turn depends upon the projectile force and upon the weights of the rifle and bullet ; that in the direction of the muzzle imparts motion to the bullet, which motion, during

the passage of the bullet through the barrel, experiences resistance from the sides of the grooves, from friction against the surface of the bore, and from the resistance of the air.

664. The projectile force continues to act while the bullet is in the barrel, causing it to move with an ever-increasing velocity until it reaches the muzzle. The velocity with which the bullet finally issues from the barrel is called the *initial* velocity, and is measured by the number of feet it would pass over in one second, provided its rate of motion remained unchanged.

665. If, after leaving the muzzle, the bullet were subjected to no other forces, it would continue to move in a straight line, following the direction of the axis of the bore, which is called the *line of fire*, and with at all points in its path a velocity the same as the initial velocity ; it would consequently pass over equal spaces in equal times.

The Force of Gravity.

666. Upon issuing from the muzzle, the bullet, which has previously been supported by the barrel, is influenced by the force of gravity.

667. This force draws all unsupported bodies toward the earth, and if it were not for the resistance of the air, would cause them, whether light or heavy or whatever their shape, to fall from any height in a straight line to its surface with a continually increasing velocity.

Under this influence all bodies would pass over about 16 feet in the first second of fall (the distance varies very slightly according to the latitude of the

place); about 48 feet in the second, or 64 feet in 2 seconds; about 80 feet in the third, or 144 feet in 3 seconds; about 112 feet in the fourth, or 256 feet in 4 seconds, and so on; the distance passed over in any second being always about 32 feet more than in the preceding second.

668. The effect of this force is to change the direction of a bullet after it has left the muzzle of the rifle. Let M (Plate XXXIV.) be the muzzle of the rifle, MD the direction of the line of fire, and suppose that the bullet leaves the rifle with a velocity such that it will, considering only the projectile force, be at A at the end of 1 second; it will then be at B , C and D , at the end of 2, 3, and 4 seconds, respectively, each of the distances AB , BC , and CD , being equal to MA .

669. Let a bullet be dropped from A ; considering only the force of gravity, it would at the end of 1 second be at a (Aa being equal to 16 feet), and if bullets were dropped from B , C , and D , they would at the end of 2, 3, and 4 seconds respectively, be found at b , c , and d ; the distances $Bb = 64$ feet, $Cc = 144$ feet, and $Dd = 256$ feet.

670. The action of the force of gravity upon bodies in motion is the same as upon those at rest, and it will therefore affect the bullet upon leaving the muzzle in the same manner as it does those let fall from the points A , B , C , and D .

Under the combined action of the projectile force and the force of gravity, a bullet will therefore at the end of 1, 2, 3, and 4 seconds, instead of reaching A , B , C , and D , be found at the points a , b , c , and d , respectively; and if these points and M be joined by

a line we will have the path followed by the bullet under the combined action of these forces.

This path is called the *trajectory in vacuo* (the resistance of the air having been neglected) and all points of it are below the line of fire. Its curvature is turned toward the earth and is much more pronounced as the initial velocity of the bullet is less.

671. The effect of the force of gravity, it is seen, is to change the path of the projectile from a straight to a curved line, and by finally bringing it to the earth to limit the distance passed over.

The Resistance of the Air

672. The bullet in its passage through the air displaces it in every direction, the resistance offered by the air to this displacement depends upon the shape of the bullet and its rate of motion, and is much greater for those bullets having a high than a low velocity. Its effect is to gradually diminish the velocity of the bullet, and to cause the spaces over which it passes in equal times to continually grow less and less.

673. This diminution of velocity will cause a ball issuing from a rifle with an initial velocity which would have brought it (neglecting the force of gravity) at the end of 1 second to the point *A* (Plate XXXIV.), to only reach some point as *A'*, and instead of reaching *B*, *C*, and *D*, at the end of 2, 3, and 4 seconds, to be found at *B'*, *C'*, and *D'*, respectively, *C'D'* being less than *B'C*, *B'C'* less than *A'B'*, and *A'B'* less than *MA'*.

674. This diminished velocity that the bullet has at

any point is called the *remaining velocity*, and is measured by the number of feet that it would pass over from that point in 1 second, provided it continued to move at the same rate as at the beginning of the second.

Combined Effect of these Forces.

675. Under the combined action of these forces it is evident that the bullet at the end of 1 second, instead of being found on the vertical line through A (as when the resistance of the air was neglected) will be found somewhere on the vertical line through A' ; but since in the case of lead bullets falling for only a few seconds (the velocity of fall being very small) the resistance of the air does not materially alter the effect of the force of gravity, the bullet will be at a' , $A'a'$ being equal to Aa , and at the end of 2, 3, and 4 seconds be at b' , c' , and d' , respectively, $B'b' = Bb$, $C'c' = Cc$, and $D'd' = Dd$.

Joining the points M , a' , b' , c' , d' , we will have the path followed by the bullet under the influence of the projectile force, the force of gravity, and the resistance of the air. This path is called the *trajectory*; it is more curved than the trajectory in vacuo; its latter part more than the first part, and its highest point is further from the rifle than from the point where it meets the ground.

676. The angle made by the line of fire, or axis of the bore prolonged with the horizontal plane (thus DMG , Plate XXXIV.), is called the *angle of fire*, and that made by the last element of the trajectory with the ground (thus, FGM , Plate XXXIV.) the *angle of fall*. The angle of fall is always greater than the angle

of fire. The vertical plane passing through the line of fire is called the *plane of fire*.

677. The *range* is the distance from the muzzle of the rifle to the point where the trajectory pierces the horizontal plane through the muzzle. The range increases to its maximum limit as the angle of fire is increased, and in a vacuum would with the service rifle and bullet M. 1881 be about 17,900 yards, the angle of fire being 45° . In air the maximum range is obtained with a much smaller angle of fire, and with the service rifle and bullet is 3,500 to 3,600 yards, the angle of fire being a little less than 30° .

The range also depends upon the shape and weight of the bullet (which influences the resistance of the air) and upon the initial velocity.

678. As the preceding paragraphs have shown that no part of the trajectory is a straight line, and that the bullet in its flight continually falls further below the line of fire (*MD*, Plate XXXIV.), it is evident that if the line of fire be directed on any object the bullet will not hit it, but will strike below it, and this departure of the bullet from the object will be greater as the distance of the object from the rifle is increased.

To counteract this fall of the bullet, the line of fire must evidently be directed as much above the object as the bullet could strike below it if the line of fire were laid directly upon the object.

679. If the barrel were of uniform thickness and the firer, by looking along its upper surface, were to direct the line of fire at any particular distance above an object, the mark would be lost sight of and inaccuracies would result both as regards elevation and direction.

It is therefore essential that the object be kept in view as the direction of the line of fire is altered, and to accomplish this the eye must be so far raised above the breech as to see the object over the muzzle of the rifle.

680. To fix the position of the eye when the line of fire is properly directed for an object at different distances, the rear sight is employed. The straight line passing through the bottom of the notch of the rear sight and the top of the front sight is called the *line of sight*, and the angle which it makes with the line of fire is called the *angle of sight*.

681. The graduations on the rear sight are so determined that when the eye is placed as indicated for any range, and the corresponding line of sight directed upon an object at that distance, the line of fire will pass as far above the object as a bullet, in traversing the distance to the object, would fall below the line of fire.

CHAPTER II.

VARIATIONS IN THE TRAJECTORY.

682. In the preceding discussion the trajectory, throughout its whole extent, has been considered as situated in the plane of sight, and the angle of sight as only affected by the three principal forces which act upon the bullet. In reality, however, there are many other forces affecting the flight of the bullet, which cause changes in the form and position of the trajectory and make necessary modifications of the relative positions of the lines of sight and fire.

683. These influences belong to two general classes, those incident to the rifle and ammunition, and those due to the peculiarities of the atmospheric conditions.

The Trajectory as Affected by the Rifle and the Ammunition.

684. *The Want of Symmetry in the Breech-loading Parts.*—The different parts of the breech system which receive and sustain that portion of the projectile force which induces the recoil not being symmetrically disposed with reference to the line of fire, a slight change is effected in the direction of that portion of the force which propels the bullet, and a deflection of the bullet therefore caused which always take place in the same direction for all ranges, and is constant for any single range, but increases in amount as the range is increased.

685. With the Springfield breech-loading system this deviation causes the bullet to strike below and to the right of the point, which without its action would have been attained. As, however, the graduations of the rear sight have been determined by actual firing, this deviation in a vertical direction is recognized and corrected.

The lateral deviation acts in the direction of the drift, and when the latter is determined by experimental firing is included with it; in the new sight it is then allowed for automatically and when the rear sight model of 1879 is employed is also included in the corrections for drift given in a previous chapter.

686. *The Rifling.*—The grooves being inclined to the axis of the barrel, tend by their resistance to re-

tard the passage of the ball, and therefore to diminish its initial velocity and also to give to the bullet a motion of rotation around its longer axis. The initial velocity of this rotation—that is, its velocity at the muzzle of the piece—will depend upon the initial velocity of the bullet and the distance measured in the direction of the axis of the piece required for one complete turn of the rifling. It will be expressed by the quotient of the former by the latter quantity.

687. The resistance of the air, combined with this rotation of the bullet, causes the axis of the bullet to approach the trajectory, its point to remain in advance throughout its flight, and also produces a lateral motion of the entire projectile. This lateral deviation of the bullet receives the name of drift; its direction is determined by that of the rifling; if the latter turns from right to left, the bullet deviates to the left; if from left to right, the bullet deviates to the right of the plane of fire.

688. The amount of drift increases as the range is increased, but in a more rapid ratio; for the shorter ranges, where the velocity of the bullet is changing rapidly for each 100 yards increment of the range, this ratio is continually increasing, becoming more fixed in value, as with a longer range the change in velocity for each additional 100 yards becomes more uniform. The projection of the trajectory on the ground will then for the shorter ranges be a curve which becomes flatter as the range is increased, but which continually departs from the plane of fire.

689. For the Springfield small arms the rifling turns toward the right; the drift will, therefore, be in that direction; its numerical value for the rifle and carbine,

at different ranges, is given in Tables I. and II. of Appendix C.

690. In the present rear sight of the rifle and carbine the correction for drift is made automatically, and may be neglected by the soldier; with the sight, model 1879, the slide being susceptible of a lateral adjustment, the proper allowance can always be made to compensate for the drift.

691. *Variations in the Dimensions of the Different Parts.*—The manner of their fabrication causes some slight variations in the dimensions of the different parts of small arms, which can be limited in amount, but practically cannot be entirely eradicated.

692. The variations which particularly affect the trajectory are those in the dimensions of the bore, the grooves, and the chamber; these mainly affect the initial velocity, and, therefore, the range and height of the trajectory at different points; also variations in the exterior dimensions of the barrel and of the bands, which may cause the latter to bind, to a greater, or less extent, at the time of discharge, and variations in the thickness of metal at different points of the barrel; these may cause horizontal as well as vertical deviations of the bullet.

In addition to these variations others are incident to the manner of assembling, to the fit of the barrel in its bed in the stock, and to the different parts of the sights.

693. The deviation of the bullet produced by the combination of these conditions will, for the same rifle, generally take place in the same direction for all ranges, but to an amount that varies from range to range.

It can be approximately compensated for at the different ranges by altering the adjustment of the rear sight, or by changing the point of aim upon the target.

694. As the deviation incident to the arm itself usually varies in extent, and often in direction, for different rifles, a knowledge of the peculiarities of one is no guide to the usual firing of another; for the soldier, to make any considerable advance in marksmanship, it is, therefore, not only essential that he should have an intimate acquaintance with the weapon that he generally uses, but if he desires his practice to present uniform results, should confine it to that particular arm.

695. *Variations in the Ammunition.*—The manner of their fabrication causes some slight variations in the dimensions of the cartridge-case and bullet, and in the weight of the powder charge; these affect the accuracy of fire in different ways.

696. Changes in the exterior diameter of the cartridge-shell affect the closeness with which it is supported by the walls of the chamber, and, therefore, alter the amount of force lost in expanding it; this results in diminishing, to a greater or less extent, the velocity of the bullet.

Upon the interior diameter and upon the length of the case depend the amount of compression which the powder receives; this and the degree of crimp to the case around the bullet also affect the initial velocity.

697. Changes in the weight of the bullet, besides influencing the initial velocity, also independently affect the flatness of the trajectory and velocity of the

bullet at different points. Changes in the diameter of the bullet cause it to fit more or less tightly the bore of the gun; this influences the velocity, and, independently of that, the accuracy of fire. The greater or less uniformity in the bullet's shape and in the disposition of the metal also exerts its influence upon the trajectory.

698. The kind and amount of powder used, the degree of compression it receives in loading, and its comparative dryness at that time, all affect the initial velocity.

699. These different influences incident to the ammunition may cause, even with cartridges manufactured with the greatest care and upon the same day, variations, when fired from the same gun, as great as 40 feet in the initial velocity. The average result, as determined by very extensive firing, extending over a long period, is to produce a mean change of about 10 feet in the initial velocity.

CHAPTER III.

THE TRAJECTORY AS AFFECTED BY THE ATMOSPHERIC CONDITIONS.

700. In treating this subject, it has been endeavored to consider the influences affecting the trajectory in no greater detail than can be easily comprehended by the average soldier, and to suggest only such corrections as can be readily applied to a military rifle, with military sights, and by any enlisted man.

701. The subject can then be best considered under three heads: I. The effect of moisture and temperature upon initial velocities. II. The effect of variations in the density of the air. III. The influence of the wind upon the lateral deflections of the bullet and upon the range.

I. *The Effect of Moisture and Temperature upon Initial Velocities.*

702. In paragraph 698 it was stated that the comparative dryness of the powder at the time of loading influenced the initial velocity; this dryness is very easily effected, the powder readily absorbing moisture from the air if left exposed to its influence, or being quickly dried by exposure in a warm, dry atmosphere. The exposure of the powder for three days in an open vessel, in a room heated by a stove day and night, will increase the initial velocity about 50 feet; an exposure for the same period in air saturated with moisture by rain (but with the powder sheltered from the rain), will decrease the initial velocity to nearly the

same extent. Such extreme conditions will, of course, not occur with cartridges carefully manufactured or re-loaded, but moderate changes in the initial velocity cannot be prevented. The effects of such changes in range and elevation are given in the following table:

TABLE.—*Mean Difference in Elevation of Point Hit, and in Range, for each 10 Feet of Change in Initial Velocity.*

Range, yards.....	100	200	300	400	500	600	700	800	900	1,000
Change on target, } inches.	0.2	0.6	1.5	2.4	4.2	6.2	8.8	11.7	15.1	19.9
Change in range, } yards.	1.7	2.2	2.8	3.1	4.2	5.0	5.5	5.8	6.2	6.5

703. The amount of moisture in the air affects the initial velocity also by influencing the character of the residuum deposited on the surface of the bore. This presents more or less resistance to the movement of the projectile through the barrel. The greater the absolute amount of moisture present, the softer does the deposit become, and the easier does the projectile pass through the bore. On moist, damp days the bullet will therefore strike high, and a decrease in the elevation will be required; on dry days the reverse effect will obtain.

704. As the temperature of the air increases, the general effect is to increase the absolute amount of

moisture, and therefore, for the reasons given above, to increase the initial velocity.

Increase of temperature also increases the initial velocity, in that less of the work of the powder gases is absorbed in heating the barrel, and a greater amount is available for its effect upon the bullet. This will produce, in cold weather, a considerable variation between the earlier and later rounds, which in warmer weather is not so noticeable.

The greater or less heating of the barrel will also cause appreciable variations in the relation of the calibre of the bore and the diameter of the bullet, which will affect the initial velocity.

II. *Density of the Air.*

705. The resistance of the air to the flight of a projectile varies directly with its density ; the density is dependent upon the latitude of the place (but for all military posts in the United States this factor is so small that it can be neglected), upon the altitude above the sea, and upon the local changes in the barometric pressure, the temperature, and the degree of moisture.

706. For every increase of height above the level of the sea, provided the temperature remains constant, the density of the air diminishes ; an increase in the range for any particular adjustment of the sights will therefore result.

The approximate increase of the range for altitudes up to 10,000 feet, over that obtained at the level of the sea, for adjustments of the sights varying by 100 yards, is given in the following table :

TABLE.—*Increase in Range due to Increase in Altitude above the Level of the Sea.*

Range.	200 yards.	300 yards.	400 yards.	500 yards.	600 yards.	700 yards.	800 yards.	900 yards.	1,000 yards.
Altitude— feet.	Yds.	Yds.	Yds.	Yds.	Yds.	Yds.	Yds.	Yds.	Yds.
1,000	1.4	2.8	4.2	5.6	7.0	8.7	11.0	13.1	15.3
2,000	2.6	5.2	8.1	10.9	13.6	17.0	21.4	25.5	29.5
3,000	4.0	8.0	12.0	16.0	20.0	25.0	31.5	37.5	43.5
4,000	5.2	10.4	15.6	20.8	26.0	32.5	41.0	48.7	56.5
5,000	6.4	12.8	19.2	25.6	32.0	40.0	50.4	60.0	69.6
6,000	7.6	15.2	22.8	30.4	38.0	47.5	59.8	71.2	82.5
7,000	8.7	17.4	26.2	34.9	43.6	54.5	68.7	81.7	94.8
8,000	9.8	19.5	29.3	39.0	48.8	61.0	76.8	91.5	106.0
9,000	10.8	21.6	32.4	43.2	54.0	67.5	85.0	101.0	117.0
10,000	11.7	23.5	35.3	47.0	58.8	73.5	92.6	110.0	127.0

707. At any constant altitude above the level of the sea, the changes in the height of the barometer will rarely exceed $\frac{1}{2}$ of an inch, which would produce the same effect upon the range that would be occasioned by a change of 10° in the temperature (see table in paragraph 708). But as the usual variations in the barometric reading will be considerably within this limit, their consideration would pre-suppose a degree of refinement not usually practicable for military firing, and it, therefore, will generally be sufficient to

take only the average height of the barometer at any firing locality.

708. Temperature, however, varying considerably, as it may during a single day's firing, and varying also at different seasons from much below zero to more than 100° above, effects marked changes in the density of the air and cannot be neglected.

As the temperature increases, the density of the air decreases; the resistance which it offers to the flight of the bullet will, therefore, be decreased and the range correspondingly increased. The approximate change in the range for each change of 10° in the temperature, is given in the following table :

TABLE.—*Change in Range, for each change of 10° in the Temperature.*

Range.....	100	200	300	400	500	600	700	800	900	1,000
Change in yards for each 10°.	0.3	0.8	1.6	2.0	3.0	4.0	5.0	6.0	7.0	8.0
Corresponding change in inches on target.	.03	.25	.82	2.0	3.0	5.0	8.0	12.0	17.0	25.0

709. The specific gravity of aqueous vapor being only about $\frac{1}{8}$ of that of air, it necessarily slightly affects the density of the air, as the amount present in the atmosphere changes. The extreme variations produced by this cause are, however, inconsiderable

compared with those produced by changes of the temperature, and for military firing no great error will result if the density of the air is taken for a $66\frac{2}{3}$ per cent. of saturation.

The above table has been deduced under this supposition; when the degree of saturation is much greater, the corrections given in the table must be slightly increased.

III. *The Effect of the Wind.*

710. In considering the action of the wind upon the flight of the projectile, the rifleman is at once met with a twofold problem. He must determine the probable effect upon elevations and upon deflections or deviations.

711. Assuming that the wind remains uniform in force, variations in its direction produce, at times, marked changes in its relative action upon the projectile, both as to range and as to deflection.

712. To arrive at any satisfactory conclusion, it is necessary to consider the wind force resolved into two component forces, one acting in the plane of fire (*i.e.*, parallel to it), the other at right angles to it. It is then possible to make the required allowances, essentially as if two independent forces were acting, each having a constant uniform direction, but a variable strength.

713. The component of the wind force acting in the plane of fire is termed *accelerating* if the wind is from the rear, and *retarding* if the wind is from the front; it affects the range in the manner indicated by the designation.

714. The component acting at right angles to the plane of fire is called *deviating* and is to the right or left as the wind is from the left or right, respectively, of the plane of fire.

715. The direction of the wind is, for convenience, expressed by a clock-face notation, the clock face being supposed to be held in the hand of the firer with the hour XII. toward the target or other object of aim, and the hour III. at the right hand. A wind blowing directly from the front (that is, from the direction of the target) is called a XII. o'clock wind; one directly from the left and across the line of fire a IX. o'clock wind, and so on.

716. The direction of the wind can be obtained by observing its effect on the smoke, on trees or grass, on flags, or upon the portion of the head or face impinged upon.

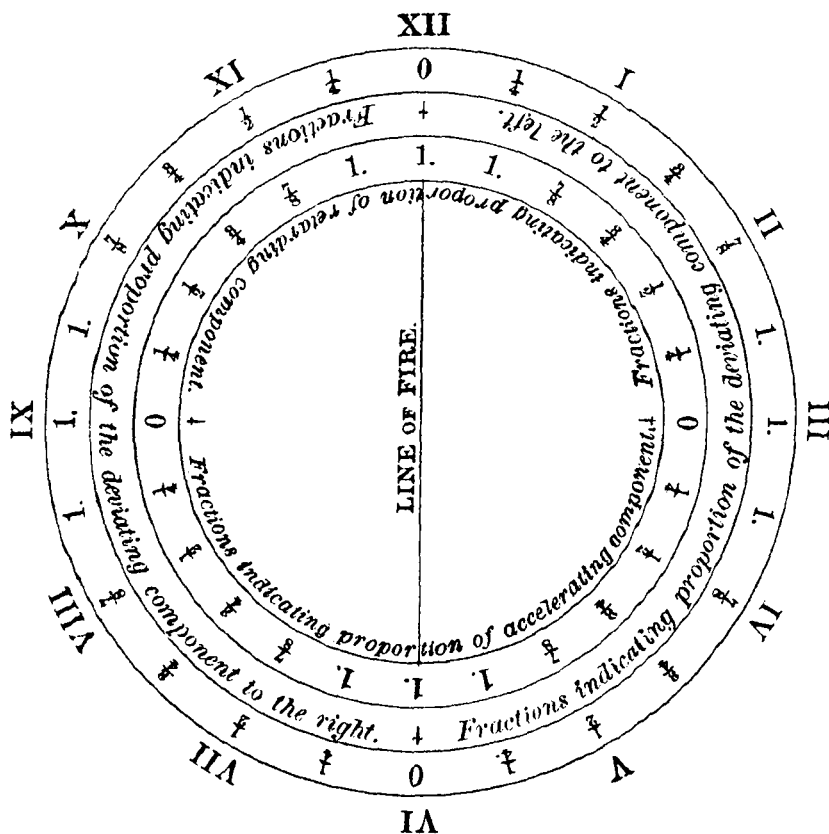
717. The force of the wind is designated in miles per hour, and can be obtained from the readings of an anemometer. It can be judged approximately by observing the manner in which the boughs of trees, and flags, are affected; also, by the sensation produced upon the face and other portions of the body. If the estimates thus formed are frequently corrected by anemometer readings, they will soon gain greatly in accuracy.

718. The following table gives the proportions of the rectangular component forces acting when the wind is from different directions. The force of the wind is assumed as unity, and the components are given in the nearest simple vulgar fraction.

Table.

Direction.	Accelerating.	Retarding.	Deviating to the left.	Deviating to the right.
XII.	—	1	0	—
XII½.	—	1	¼	—
I.	—	¾	½	—
I½.	—	¾	¾	—
II.	—	½	¾	—
II½.	—	¼	1	—
III.	0	—	1	—
III½.	¼	—	1	—
IV.	½	—	¾	—
IV½.	¾	—	¾	—
V.	¾	—	¾	—
V½.	1	—	¼	—
VI.	1	—	0	0
VI½.	1	—	—	¼
VII.	¾	—	—	¾
VII½.	¾	—	—	¾
VIII.	½	—	—	¾
VIII½.	¼	—	—	1
IX.	0	0	—	1
IX½.	—	¼	—	1
X.	—	½	—	¾
X½.	—	¾	—	¾
XI.	—	¾	—	¾
XI½.	—	1	—	¼

719. The foregoing table is given in a more convenient form in the following dial:



720. An examination of the foregoing table or dial shows that slight changes of direction when the wind is near XII. or VI. o'clock make considerable changes in the values of the deviating components, while but little change occurs in the values of the retarding or accelerating components. Hence with the wind varying between XI. and I. o'clock, or between V. and VII. o'clock, the deviating allowance must be carefully observed, while the elevation remains comparatively unchanged. On the other hand, when the wind is between II. and IV. o'clock, or between VIII. and X. o'clock, the deviation allowance will be changed but little, while the change in the elevation may be considerable.

721. The lateral deflections produced by the wind have been found to be practically directly proportional to the deviating component of the wind. The amount of deviation produced by one mile of wind, acting at right angles to the plane of fire, is called the *coefficient of deviation*.

722. The following is a table of the coefficients of deviation for the Springfield rifle with the service cartridge (70 grains of powder, 500-grain bullet). It is given in inches of deflection on the face of the target and in approximate fractions of a *point* of division of the deflection scale or wind-gauge of the sight :

Table.

Range, yards	100	200	300	400	500	600	700	800	900	1,000
Inches on target. . . .	.33	1.5	2.5	4.0	5.5	7.5	10.0	13.0	17.0	22.0
Approximate frac- tions of a point of sight. }	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{1}{7}$	$\frac{1}{6}$	$\frac{1}{5}$	$\frac{1}{4}$	$\frac{2}{7}$	$\frac{1}{3}$	$\frac{3}{7}$	$\frac{1}{2}$

723. The effect of the wind upon the range has not yet been satisfactorily solved ; but from computations based upon the most reliable data and methods, it would appear that one mile of wind acting on the line of fire will produce upon the range, at all distances, the same effect as would follow from a change of $2\frac{1}{2}$ degrees in the temperature.

724. The amount of correction for different head or rear winds can then be obtained by an application of the table in paragraph 708 ; a little less than one-fourth of the changes in range there expressed being the change in the range produced by one mile of wind.

CHAPTER IV.

THE EFFECTS OF FIRE.

Velocity and Range.

725. THE velocities, at different distances up to 1,000 yards, for the bullet fired from the rifle and carbine are given in Tables I. and II. of Appendix C.

726. For the shorter ranges the relative loss of velocity is greater for those bullets having originally the greater initial velocity, and is also greater for a light than for a heavy bullet, having the same cross section.

727. This decrease in the remaining velocity becomes much less as the range is increased beyond 1,500 yards, and at different distances approaching the maximum range, the remaining velocities of the same bullet are sensibly the same; the loss of some of the velocity originally imparted by the projectile force being to a great extent compensated for, by that acquired by the bullet in falling through the height due to the increased elevation. At these great ranges the remaining velocity is not affected by slight changes in the powder charge, the variations in the initial velocity being neutralized by the resistance of the air long before the ultimate range is reached.

728. The extreme range is also but slightly influenced by small changes in the powder charge, but very greatly by an alteration in the weight of the bullet; a heavier bullet being better able to overcome the resistance of the air. This is shown by a comparison of the old with the present service cartridge; both having 70 grains of powder, the former a bullet of 405 grains and the latter one of 500 grains. In this case the addition of about $\frac{1}{4}$ to the weight of the bullet increases the range from 2,950 to 3,500 or even to 3,600 yards. Increasing the powder charge to 80 grains has very little, if any, effect upon the extreme range of the 500-grain bullet.

Energy and Penetration.

729. The energy or force of impact of the rifle and carbine bullets at different distances is given in Tables I. and II. of Appendix C. The penetration in white pine is also given in the same table. For the rifle bullet, the penetration at ranges of 2,000 to 3,500 yards, is about $2\frac{1}{2}$ or 3 inches; for the carbine bullet, at distances of 2,000 to 2,500 yards, it is a little over 1 inch. For all distances up to the extreme range of the rifle or carbine, a dangerous wound (considered as corresponding to a penetration of 1 inch in pine) would therefore be produced.

730. Provided the bullet retains its shape upon striking, the penetration will depend upon the energy which in turn is a function of the velocity; but the lead bullet being readily deformed, there is a limit beyond which an increase in the velocity will diminish the penetration.

731. Thus in sand, at a distance of 5 or 10 feet, the penetration is only 3 or 4 inches, the high velocity not affording time for the displacement of the particles of sand, and the bullet therefore being completely deformed; while at 50 yards the penetration is increased to about 9 inches; it is about 10 inches at 3,500 yards.

732. The penetration is much greater in earth loosely thrown up, than when it is packed or rammed; it is also greater in earth whose particles admit of easy displacement than in sand where the angular shape of the particles increases their cohesion. The penetration in earth is not generally greater than 2 or $2\frac{1}{2}$ feet; it seldom reaches 3 feet. A steel plate $\frac{1}{2}$ inch in thickness will not be penetrated at any distance; one $\frac{1}{4}$ inch

thick at no distance greater than 100 yards, nor one $\frac{1}{4}$ inch thick at distances over 400 yards.

Time of Flight.

733. The time of flight for the rifle and carbine bullet, for ranges from 100 to 1,000 yards, is given in Tables I. and II. of Appendix C. The time of flight increases more rapidly than the range; for the longer ranges it is for the rifle, $17\frac{3}{4}$ seconds for 3,000 yards; and for the carbine, $5\frac{1}{2}$ and $10\frac{1}{4}$ seconds for 1,500 and 2,000 yards respectively. The angle of fall of the rifle bullet at the extreme range of 3,500 yards is about 65° .

Accuracy.

734. In consequence of the variations in the different parts of the small arm and cartridge, bullets fired with a constant aim, from the same gun, on the same day, and under similar meteorological conditions, will strike points of the target more or less widely separated. The degree of concentration of the hits will depend upon the extent of these variations, and will therefore afford a measure of the accuracy of the piece.

735. The central point of a cluster of shots is called the centre of impact, the horizontal distance of a shot from this point its horizontal deviation, and the vertical distance the vertical deviation. The mean of the horizontal deviations of all the shots will measure the accuracy of the piece in a horizontal direction, and the mean of the vertical deviations its vertical accuracy. The square root of the sum of the squares of

those two distances, will then express the average distance of all the shots from the centre of impact; this is called the mean absolute deviation of the arm, and shows the average error that may be expected when the piece is so accurately directed, that the point aimed at coincides with the centre of impact.

736. The mean absolute deviation of the Springfield rifle and carbine is given in Tables I. and II. of Appendix C. An examination of these tables shows that up to a range of 700 yards for the rifle and 500 yards for the carbine, accuracy decreases almost uniformly as the range increases; for longer ranges the decrease in accuracy is more rapid than the increase in range.

737. The influences effecting the accuracy of the piece, whenever a great number of shots is considered, cause the mean vertical deviation to exceed the mean horizontal deviation. This excess, which is but slight at first, increases as the range is increased, until at 300 yards it is about 15 per cent., at 500 yards about 20 per cent., and at 1,000 yards about 30 per cent. of the horizontal deviation. Under favorable meteorological conditions, accurate firing is, therefore, more readily attainable in a horizontal than in a vertical direction.

Dangerous Space.

738. The trajectory cuts the line of sight in two places, the first near the muzzle, the second at the point aimed at (supposing that point to be struck); between these two points all portions of the trajectory are above the line of sight. The heights of different points of the trajectories, for different ranges, above the corresponding lines of sight are given for the rifle in

Appendix C, Table III., and for the carbine, in Table IV.

739. If an object situated on horizontal ground, extends both above and below the point aimed at, there will be a distance in front of it where the trajectory will not be above its highest point, and some distance beyond it before the trajectory will meet the ground at the level of its lowest point; it is therefore evident that for this trajectory there will be a space, in the direction of the plane of fire, rendered dangerous for the object. Thus in Plate XXXV., Fig. 1, for an object of the height AB , and a trajectory TD , the dangerous space will be the distance CD , and if occupying any point of this space, the object AB would be hit by a bullet following the trajectory TD .

740. The extent of the dangerous space depends upon the height above the ground from which the fire is delivered; upon the flatness of the trajectory, the height of the object and its distance from the origin of fire, and upon the configuration of the ground where it is situated.

741. When other conditions are the same, the dangerous space will be greater for fire delivered from a lying, than from a standing, position; it will be greater when the object is a soldier standing, than for one lying down or kneeling, and still greater for a mounted man.

742. The dangerous space for the rifle, fired standing, against infantry kneeling and standing, and against cavalry, at ranges from 100 to 1,000 yards is given in Table V. of Appendix C. Table VI. gives the dangerous space for the rifle, fired lying down, against infantry kneeling and standing, and against cavalry;

and Table VII. the dangerous space for the carbine, fired standing, against infantry and cavalry. The dangerous spaces are calculated under the supposition that when firing standing, the muzzle of the piece is 56 inches from the ground, and when firing lying down 12 inches ; that the height of a man kneeling is 3 feet 6 inches and of one standing 5 feet 8 inches, and that the height of a man mounted is 8 feet ; also, that aim in all cases is taken at the middle point of the object.

743. When the distance of the highest point of the trajectory from the ground does not exceed the height of the object, the entire distance from the muzzle of the piece to the point beyond the object where the shot strikes the ground, will constitute the dangerous space. When the rifle is fired standing, the maximum of this dangerous space is obtained against infantry kneeling by a range of 215 yards, against infantry standing by a range of 255 yards, and against cavalry by a range of 310 yards ; the dangerous space beyond these objects is 41, 60, and 72 yards respectively. For the rifle fired lying down against infantry kneeling and standing, and against cavalry, the maximum dangerous spaces correspond to ranges of 312, 347, and 370 yards, with further dangerous spaces beyond the objects of 44, 53, and 70 yards respectively. For the carbine, against infantry standing, the maximum dangerous space is given by a range of 247 yards, with a further dangerous space beyond the object of 55 yards. When the rear sight is adjusted for these ranges the enemy would be covered at all distances up to the indicated ranges, and would also be hit up to the additional distances given above.

744. At distances of 2,000 yards the angle of fall is

Fig. 1

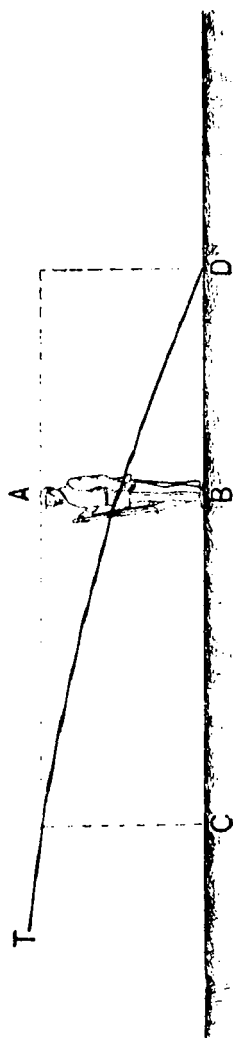
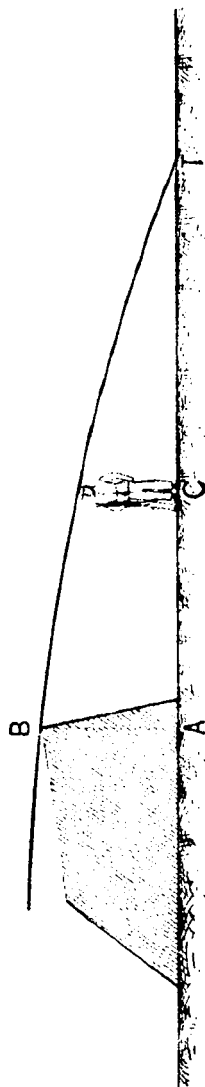


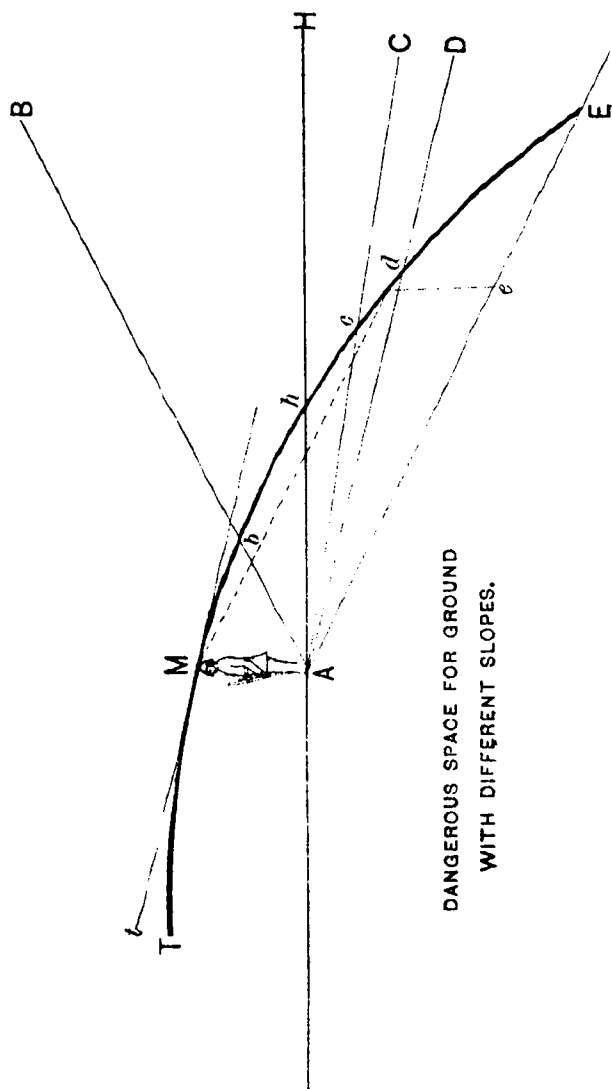
Fig. 2



so great that the bullet generally buries in the ground, but at lesser distances it usually ricochets, and often several times, especially at the shorter ranges. The ricochet will generally take place when the angle of fall does not exceed 15° and the ground is hard and smooth; in general the extent of the rebounds will be increased as the angle of fall is diminished; the effect of the ricochet is to very materially increase the dangerous space. At long ranges, when the angle of fall is great, the dangerous spaces are nearly proportional to the height of the object.

745. If the ground where the object is situated is not horizontal its slope will very materially influence the extent of the dangerous space. If the object is situated on rising ground the angle of fall will be increased and the dangerous space, therefore, diminished; but if on falling ground the dangerous space will be increased as the slope of the ground becomes greater, until its inclination exceeds that of the tangent to the trajectory at the point which marks the limit, nearest to the firer, of the dangerous space for horizontal ground.

746. Thus in Plate XXXVI., for an object of the height AM , and the trajectory TE , to which tM is the tangent at M , the dangerous space on horizontal ground will be Ah , on rising ground Ab , on falling ground Ac , which will reach its maximum Ad , for ground AD parallel to the tangent tM . When the slope increases beyond this limit, as AE , the height of the trajectory between A and e will exceed AM , and the dangerous space will be reduced to the position A , and to the distance eE , the distance Ae not being covered by the trajectory.



DANGEROUS SPACE FOR GROUND
WITH DIFFERENT SLOPES.

747. For short ranges, when the trajectory is quite flat and the angle of fall small, the dangerous space is greatly increased by even a slight slope of the ground below the line of sight. As the range is increased this effect is reduced; for the trajectory of 600 yards a downward slope from the nearest point of the dangerous space of one on fifty, but slightly more than doubling the dangerous space, and for the 1,000 yards trajectory increasing it only about 25 per cent. At this latter range a slope of one on twenty would have the effect of doubling the dangerous space. At extreme ranges it would be considerably increased only by a decided inclination of the ground.

Defiladed Space.

748. An obstacle of sufficient thickness to prevent the penetration of the bullet will protect from fire the space extending from its foot to the point where the bullet, which grazes its crest, meets the ground. The extent of the defiladed space will depend upon conditions similar to those which affect the dangerous space, therefore upon the height of the shelter and upon the curvature of the trajectory, which is in turn determined by the range.

749. In Plate XXXV., Fig. 2, the distance AT will represent the defiladed space for the trajectory BT , and an obstacle of the height AB . The soldier beyond T would be struck by bullets passing a slight distance over the crest B ; he would be partly sheltered between T and C (the dangerous space for this trajectory), and would be completely protected throughout the distance AC .

750. If the height of the shelter is less than that of

a man standing, only a partial protection will be afforded, and complete shelter can only be attained by the soldier kneeling or lying down, but even in such cases the efficiency of the fire will be greatly diminished in that the flight of a portion of the bullets will be arrested.

751. If the ground, instead of being horizontal, slopes upward behind the shelter the defiladed space will be diminished; if it slopes downward it will be increased. Table VIII. of Appendix C gives the extent of the defiladed space for obstacles of different heights, situated at different distances from 100 to 1,000 yards.

Form of Sheaf.

752. When a great number of shots are fired by the same soldier, the variations due to the rifle and cartridge, and those incident to the firer himself, will cause the trajectories described by the different bullets to form a kind of sheaf, separating at the muzzle, and spreading out in all directions as the distance from the muzzle increases. The axis of this sheaf, or the path that would be described by a bullet subjected to the mean of the deviating influences, is called the mean trajectory.

753. Sections of the sheaf perpendicular to the mean trajectory resemble in their general form an ellipse whose transverse axis is in the plane of the mean trajectory. For short ranges the difference between the two axes of this ellipse is not considerable, but, as the range is increased, the transverse axis increases more rapidly than the conjugate.

754. When fire is delivered with the same elevation upon the same object by a group of men, the influ-

ences which caused a dispersion in the fire of a single soldier are increased by others due to the individual peculiarities of the men, and to the employment of different arms. A series of trajectories will result, forming a sheaf analogous to the sheaf for individual fire, but whose dimensions in every direction will be much greater.

755. The effect of this collective fire with the Springfield rifle has not been determined, but with weapons and soldiers of some other nations certain conclusions have been reached which would probably also obtain with our men and rifle.

756. When the ground is horizontal, if the abnormal shots be rejected and the space containing 90 per cent. of the hits be considered, the breadth of the ground struck—when all the rifles are directed at the same point—is found to increase directly as the range increases up to about 1,500 yards; beyond that distance this breadth increases more rapidly than the range. For a range of about 500 yards the ground struck is about 5 yards in width, at 1,000 yards about 10 yards, and at 1,500 yards about 15 yards wide. At 1,800 and 2,400 yards the width of the ground struck is respectively about 20 and 40 yards.

757. The depth of the ground struck decreases in a smaller ratio than the increase in the range, being, if 90 per cent. of the shots are considered, about 275 yards for the 500-yard range, about 225 yards for the 1,000-yard range, and nearly 200 yards for the 1,500-yard range. If only the densest part of the group is considered, or that containing about 50 per cent. of the shots, the depth of the ground struck will vary but little from 100 yards for all ranges up to 1,500 yards.

758. These dimensions will of course vary with the proficiency of the men in the use of their weapons, the shots being more concentrated as the men become more expert.

Employment of Fire in Action.

759. The different kinds of fire most appropriate for the various stages of an action depend upon the size of the object, especially as compared with the height of the shot group and upon the greater or less certainty of its distance; the degree of the soldier's proficiency with his weapon; the moral condition of the troops; the amount of ammunition; and finally upon the accuracy of fire of the rifle, and the flatness of the trajectory at different ranges.

760. The distances beyond which the fire upon different objects will produce but a slight effect, can be only approximately stated; the ability of the men, the state of the weather, the stage of the action, may all cause considerable modifications.

761. As a general rule, however, the fire of the average individual soldier will not prove effective without the expenditure of considerable ammunition, when directed upon a single man, lying down, at a greater distance than 250 yards; upon a man kneeling, beyond 400 yards; upon one standing, beyond 500 yards; upon a mounted man beyond 600 yards; or upon a set of fours, lying down, beyond 700 yards. At the latter distance the fire would usually be effective against a line of skirmishers (5-yard intervals); up to 800 yards against a line with the intervals reduced one-half; and up to 900 yards against a line of skirmishers with intervals reduced to one yard. Fire

upon a body of men, in closed ranks, of the width of a company front (12 to 15 yards), will generally be effective up to 1,000 or 1,100 yards; upon a body of men with a front of 20 or 25 yards, or upon a section of artillery up to 1,200 or 1,300 yards; upon columns of companies, or small, compact bodies of artillery or cavalry up to 1,500 or 1,800 yards. Beyond these distances aimed fire will not usually be effective, and should not be attempted except upon large bodies of troops. If the supply of ammunition will permit the expenditure of a great number of cartridges, unaimed, or more properly curved fire, may be conducted up to the extreme limit of rifle range by troops in position acting in the defensive. In the case of troops forming for an assault or advancing to the attack of other troops under cover, the employment of such fire is decidedly disadvantageous.

762. When the enemy is at only a moderate distance (500 or 600 yards), the flatness of the trajectory, and, if the ground is favorable, the added effect of the ricochet, render the slight errors which may be made in the estimation of the range, of but little importance. When he approaches within the continuous dangerous space of the rifle, no further changes in the adjustment of the sight should be made as his distance varies. If the troops are firing standing, an elevation of 250 yards, if firing lying down, an elevation of 300 yards should be permanently adopted, and aim taken first at the waist and then somewhat lower as the distance decreases.

763. For longer ranges, not exceeding those where an estimation of the distances can be depended upon to within 100 yards, the depth (100 yards) of the

ground well covered by the fire of a body of men will still render the fire effective even if the correct range is not assumed. That the effect of the ricochet may not be lost care should be taken not to over-estimate the distance, and to aim at the feet of the enemy. This selection of a point of aim is in fact, except when the enemy is within short range, especially advantageous, as, when it is employed, a greater number of the bullets in the shot group will usually prove effective, and as moreover the line of separation which exists between the cloud of smoke and the ground offers the best defined object, and also the error so common in the heat of action of taking too full a sight is neutralized.

764. For still longer ranges, when the distance is a matter of some uncertainty, and especially when the enemy is in motion, the simultaneous employment by different bodies of men of two or more elevations possesses some advantage. If two different sights are chosen they should differ by 100 yards, one 50 yards greater, the other 50 yards less than the estimated distance. The fire will of course be less concentrated but a much greater extent of ground will be covered. The employment of different elevations by small bodies of men should never be permitted.

765. For troops behind shelter acting on the defensive, the employment of volley firing possesses many advantages. It enables the officers to govern the direction of the fire and control its extent and the expenditure of ammunition. It permits the officer to regulate the adjustments of the rifle sight and to require all to adopt the one deemed most appropriate; and finally it affords the officer the best means of retaining a full control over his men, an element of

great importance, especially in the case of undisciplined troops. As the enemy approaches toward the distance from which his final rush may be expected, or even before that period, if into ground affording little or no shelter, the volley fire of the defensive should be replaced by independent fire, conducted at first slowly and deliberately, and finally pushed to its utmost limit.

766. For the offensive, volley firing should be conducted by troops especially selected and posted on the flanks of the attacking force or upon some dominant position in the rear. It can then be employed only at long ranges and before the attacking force is fully engaged. The element of immobility and relative security incident to volley firing is entirely incompatible with a vigorous offensive, and makes its employment by the troops executing the attack unadvisable. Individual or independent fire, conducted at first slowly and with frequent pauses, is preferable; the pauses permit the smoke to clear away, the officers to observe the effects of the fire and to make such changes as may be advisable in the disposition of the troops, and to re-establish calmness and steadiness among the men. At the middle, and especially at the latter stages of the assaults, the firing should be conducted continuously and as rapidly as possible, its effectiveness being principally due to the flatness of the trajectory rather than to any great accuracy of aim. After a position is carried by troops having orders not to advance beyond a certain point, the employment of volleys against a retreating enemy is advantageous, and will quickly bring the attacking force under the complete control of its officers.

767. The distances at which fire should be opened depend greatly upon the supply of ammunition and the opportunities for replenishing it, the nature of the ground, and the size and tactical importance of the objective. Long range fire should generally be employed by troops acting on the defensive, particularly if in a permanent position, when the supply of cartridges will be practically unlimited; it should, however, always be under the control of the officers, both as to the time for firing and the number of shots delivered. With its use several lines of fire, one posted above the other, can be directed upon the same portion of an attacking force. It will obviate the necessity of occupying many points which can be covered from the main line. It unduly hastens the deployment of an attacking force, compelling them to take up the formation for combat at a considerably greater distance, and thus making it harder to correct any erroneous dispositions; besides the casualties occasioned it impairs their morale, draws their fire at a time when it is not very effective, thereby decreasing their supply of ammunition, and may greatly increase the difficulties attending their occupancy of some important position, though it cannot prevent its final accomplishment.

768. Long range fire on the part of the offensive should be conducted by specially selected troops; it will be often possible by this means to deceive the defender as to the real point of attack. It possesses great value in turning movements, since it will be possible to suddenly pour in a heavy enfilading fire from a considerable distance. It enables a powerful fire to be concentrated on any point of the defender's

line, since troops from distant parts of the field can take part in it, and if the position attacked is on the crest of a dominating plateau, it will so sweep the ground in the rear as to increase the difficulties of bringing forward re-enforcements. Its employment by the attacking column is not desirable; it unduly depletes their supply of ammunition and greatly retards the advance, often occasioning serious halts. It will be better not to open fire until within 1,000 yards of the position to be attacked; even then it will not be very efficacious, but it encourages the men, is in fact very difficult to prevent, and moreover, the smoke hides the attacking force from the enemy. Against a retreating force long range fire is particularly useful, and should be conducted up to its extreme limits.

769. Fire discipline, upon which to a great extent the effect of the fire at every stage of the action depends, cannot be obtained by instruction in rifle firing alone, but requires a thorough drilling and instruction in the various duties of the soldier, a habit of prompt and unquestioning obedience, and an implicit confidence in the judgment of their officers. It is requisite that the officers charged with the control of the fire should be thoroughly self-possessed and able to decide promptly any questions that may arise; that they should be educated in the estimation of distances, be able to determine at a glance the comparative importance of different objectives, and also have a thorough knowledge of the ballistic properties of the weapon with which their men are armed, and of the effects which it may be expected to produce.

PART VII.

ESTIMATING DISTANCES.

CHAPTER I.

MEASURING DISTANCES BY PACING.

770. In the preceding chapters the extreme accuracy of fire of which the rifle is susceptible in the hands of disciplined and instructed troops has been fully explained, and the results expressed which in action it may be expected will be accomplished when the true distance of the enemy is closely known.

771. The degree of approximation in the estimate of the distance of the opposing force, which in the preceding discussion it is expected the soldier will attain, precludes the possibility of an error of more than $\frac{1}{10}$ in estimating distances up to 300 yards, of more than $\frac{1}{4}$ up to 600 yards, and of more than $\frac{1}{8}$ for distances up to 1,200 yards. If this degree of accuracy is not reached, the rifle will, judged by the effects of its fire, no longer be an arm of precision, and any knowledge that the soldier may have of the effect of the wind, of the temperature, and of the other influences which deflect the bullet in its flight will have but a moderate value, if his estimate of the enemy's position is greatly in error.

772. While, in action, for fire at long ranges the

distance will often be determined by the officer with some one of the many instruments devised for that purpose and communicated to his men, yet there will often be times when the soldier will be called upon to estimate independently the distance of his enemy, and it is, therefore, requisite that he should have become proficient in this important subject for all distances up to at least 1,000 yards.

773. As the necessary instruments for determining the proper range may not always be available, the officer should also be able to estimate with facility and accuracy the distance of different objects up to 1,500 or 2,000 yards; this latter limit being that of the graduations on the rifle sight may be considered as expressing the extreme distance at which, with the present service rifle and its improved sight, aimed fire would under any ordinary circumstances be opened.

774. The methods of estimating distances without the use of range-finders, as the more or less elaborate instruments devised for the purpose are called, can be classed under two heads—those by sight and those by sound. The instruction of the soldier in either of these methods will be facilitated if he is first taught to measure by pacing, different distances with considerable accuracy.

775. The object of this instruction is to teach men the relation which exists between their usual step and a distance of 100 yards, and therefore, when this relation is known, to enable them, by counting the steps required to traverse any distance, to determine its extent with considerable accuracy and great readiness.

776. This instruction can be easily imparted by measuring, with a surveyor's chain or tape, successive

distances of 100 yards along the road usually taken by the company in passing from their barracks to their target ground. The limits of each of these distances should be permanently marked by stakes driven in the ground.

777. When the company, *en route* to the target ground, arrives at the first or these stakes they should break ranks and be directed to pass, one man at a time, along the measured distance, counting their steps and being careful that they are of the length they would naturally take in walking when out of ranks. Such an interval should be established between successive files as will prevent the possibility of any regularity in the cadence or length of step of the different men. As each man arrives at the stake marking the first 100 yards, he will halt, and enter in the appropriate place in his individual target record book the number of steps required to traverse the distance; or a non-commissioned officer may be stationed at this stake, who will make the entry in the soldier's target record book, upon receiving from him a report of the number of steps taken. The soldier will then walk over the second 100 yards, counting his steps (calling the first step one), and at its termination halting and recording as before the number required to traverse that 100 yards. This will be continued in the same manner for each of the 100 yards, that may be measured along the road. The number marked out will of course depend somewhat upon the distance of the range from the barracks; if this distance equals or exceeds 500 yards, at least five intervals should, if possible, be measured. Upon returning from the target ground these measurements should, if considered de-

sirable, be repeated, and the instruction continued on successive target days until, in the estimates made, the desired degree of uniformity is attained.

778. The soldier should be cautioned to preserve a uniform length of step and not to permit his approach to any one of the limiting stakes to influence him, otherwise the tendency will be to so alter the concluding steps in the successive distances as to make their number conform to that just previously determined.

779. When first exercised in thus measuring 100 yards, the soldier will notice considerable differences in his determinations; these, as the practice is continued, will, however, soon disappear, until he should finally be able to measure this distance with variations not exceeding two or three steps.

780. When this degree of proficiency has been reached on smooth and level ground, the soldier should be practised on that which is more or less broken or rolling. While for this purpose it may not be possible to obtain ground as easy of access as that previously specified, yet care should be exercised to select such as can be traversed by the soldier without much inconvenience either in going to or else in returning from the target range.

781. After the soldier is thoroughly instructed in measuring 100 yards over different varieties of ground, he should be practised in determining long distances; these should first have been measured with a chain, and their extremities so marked with a flag, or other object, that either end shall be distinctly visible from the other. The true distance should not be communicated to the men until each has paced the ground several times.

782. As in the previous exercises, this should, if possible, be conducted while *en route* to the target ground and without making any considerable *détour*. Each soldier should count his steps, noticing the nature of the ground traversed and remembering the number of steps required for each 100 yards of the particular and changing variety of ground. When he has taken the number of steps which he considers corresponds to 100 yards of the special ground traversed, he should either record that fact in his target book or by extending in succession the thumb and fingers of one hand, or of both hands if necessary, keep in that manner a running record of the number of entire 100 yards. When he has reached a point less than 100 yards from the object whose distance he is measuring, he will note the number of 100 yards he has traversed. He will then count in the same manner the number of steps required for 10 yards ($\frac{1}{10}$ of the number required over the same kind of ground for 100 yards), and so continue until he is within less than ten yards of the object; the length of his step should then be increased to one yard. The combination of these results will give the distances measured.

783. The true distance as well as the soldier's determination of the measurement should be entered in his target record book; he can then from an examination of the results, form an estimate of the degree of approximation he generally attains, and, as later explained—when in the exercises of estimating distances by sight he acts as a marker—the instructor can determine the relative weight to be given to his measurements and to those of other men in the same squad of markers.

CHAPTER II.

ESTIMATING DISTANCES BY SIGHT.

784. In order that satisfactory or trustworthy results should be obtained in estimating distances by sight, constant and most painstaking practice is necessary. Unlike target firing at known distances, where careful instruction will make every soldier, with but few exceptions, a good shot, it seems to be impossible to so instruct some men that their estimates will be at all uniform or possess any considerable value; on the other hand some soldiers appear to possess a natural aptitude for the practice, and with a little experience quickly become very expert. While to some extent all men should receive instruction in the subject, it will be practically advantageous to extend the practice of only the most proficient beyond 600 yards.

785. In determining distances by sight the estimate is based upon the distinctness with which the object can be seen, upon its apparent height when its dimensions are known, and by a comparison of the extent of ground between it and the observer with some other known distance, which is either within view or so distinctly impressed upon the soldier's memory as to serve accurately as a unit of measure. These two different methods should be taught simultaneously.

786. The distinctness with which any object at any particular distance is visible varies considerably with different men, no inflexible rule can, therefore, be expressed, but for men of ordinary eyesight and under

ordinary conditions of air and light, the following general rules are applicable.

787. At 30 yards the white of a man's eyes is plainly seen, and the eyes themselves up to 80 yards.

At 100 yards all the parts of the body are seen distinctly, slight movements are perceptible, and the minute details of the uniform can be distinguished.

At 150 yards the buttons on the blouse can still be separately distinguished.

At 200 yards the outlines of the face are confused and the rows of buttons look like stripes.

At 300 yards the buttons are no longer visible.

At 400 yards the face is a mere dot, but all movements of the legs and arms are still distinct.

At 600 yards details can no longer be distinguished, though the files of a squad, if the light is strong, can be counted.

At 800 yards the men in a squad cannot always be counted, nor their individual movements distinguished.

At 1,000 yards a line of men simply resembles a broad belt; the direction of their march can, however, be readily determined.

At 1,200 yards infantry can be distinguished from cavalry.

At 2,000 yards a mounted man appears as a mere speck or dot.

788. For estimating distances, the unit of measure with which the soldier is most familiar, is the shortest range (100 yards) at which target practice is conducted. This is constantly before his eyes and becomes insensibly impressed upon his memory. In estimating only moderate distances, this unit is too long for accurate use, the soldier should, therefore,

be cautioned to endeavor to divide it into equal parts (as halves or quarters) and to apply one of these fractional portions as the unit in estimating any particular distance.

789. For the independent instruction of the soldier in estimating distances by sight, the preliminary practice requires that the instructor should measure on the ground a straight line and mark on it the origin and the distances 50, 100, 150, 200, 250, and 300 yards. The squad being stationed at the origin, markers, of as nearly the same height as possible, should be posted at these different distances, and facing the squad, at first standing at ease and afterward kneeling and lying down; the instructor then questions the men successively as to the different parts of the figure, arms, accoutrements, and dress which they can still perceive distinctly on the soldier placed at 50 yards, and also those which they cannot clearly perceive. He does the same with reference to the markers at each of the other distances, and finally directs the soldier to contrast the appearance of the first marker with that of the others, questioning the men in succession as to the results of their observation. This will develop and educate the power of observation which is dormant in many men.

The soldier will also be directed to notice the division of the ground between him and the marker at 300 yards into intervals of 50 yards, as indicated by the different markers, and to compare the apparent length of each of these successive intervals; he will also be directed to endeavor (ignoring the intermediate markers) to mentally divide the extreme distance into

intervals of 100 yards and into shorter distances, and also using the 50 yards interval nearest to him as a unit of measure to apply it mentally along the ground, toward each of the markers in succession.

790. As the atmospheric conditions and nature of the background greatly affect the degree of visibility of the markers, this instruction should be conducted in different varieties of weather and along lines variously situated with reference to the sun and any surrounding hills or woods. At each exercise the attention of the men being called to the nature of the atmosphere, whether hot or cold, misty, damp, or dry, and to the position of the sun with reference to the markers, and whether it is overcast or shining brightly. The nature of the background should also be noticed, whether or not in contrast with the dress of the men, and whether dark or bright, as when a man is distinctly outlined against the sky.

791. The soldier, using for the purpose such pages of the estimating distance practice in his individual target record as may be necessary, should record the results of his observations, and also the atmospheric conditions, and when the exercise is repeated compare them with the observations previously made.

The squads for these exercises should, if practicable, consist of at least 12 men, in order that the 6 markers may be relieved and afforded instruction in their turn.

792. When it is considered that the men are sufficiently instructed in these preliminary exercises, they will be practised in forming an estimate of unknown distances (up to 300 yards) over different varieties of ground.

793. For this purpose advantage will now be taken of the ability the men should previously have acquired to accurately measure distances by pacing, and markers, each provided with a small staff and flag, should be sent out in different directions. Ground should, if possible, be selected with which the men are not very familiar, and which has not been used in the preliminary instruction.

794. When the markers, each counting their steps as they go, have reached positions previously designated by the instructor, they will stand at ease, and the men of the squad will be called up in succession and directed, noticing the background and atmospheric conditions, to observe the appearance of each marker, and to compare their observations with the records they have entered in their individual record book for men at known distances ; they will also endeavor to mentally measure the ground by means of a standard unit, which should have previously been impressed upon their memory.

795. As each man makes his estimate of the distance of each marker, he should inform the instructor, in a low voice, of his conclusion, assigning his reasons for each particular determination, and enter the estimated distance in his target record book.

796. When all have estimated, the markers will be signalled to report their distance from the squad. Each marker while standing at ease for the observation of the squad should, from the number of steps taken to reach his position, have calculated the distance he has traversed, and upon noticing the signal of the instructor, each in succession will report the distance by lowering his flag to the right to signify

hundreds of yards ; to the left, for tens of yards ; and to the front for single yards.

797. Any errors that may have been made by men of the squad in estimating the different distances, will be noticed and their attention called to the true distance, to the appearance of the marker, and to the apparent length of the intervening ground.

798. The markers will then be signalled to return ; in returning they will again count their steps, and if this second determination of the distance differs materially from the one they signalled, a mean of the two will be adopted and the effect of the correction upon the accuracy of the estimates of the men in the squad called to their attention, the final determination of the marker's distance will then be entered in the soldier's target record book opposite his estimate.

799. These exercises should be repeated, with the marker's kneeling and lying down, and under various conditions of ground and of atmosphere and background, and be continued at different times until the men, for all distances under 300 yards, commit errors no greater than $\frac{1}{10}$ of the true distance. The errors of the more proficient soldiers should not exceed $\frac{1}{20}$ of the true distance.

800. The exercises of the men who exhibit the most proficiency, should be extended for distances up to 600 yards. For this purpose the line or lines previously measured up to 300 yards should be prolonged to 600 yards, and the intervals of 50 yards designated. Two markers should be assigned to each of these points beyond 300 yards ; the soldier questioned as to their appearance, and the preliminary instruction

continued in the same manner as previously described for distances less than 300 yards.

801. Upon the conclusion of the preliminary instruction, these men will be exercised in estimating distances by sight up to 600 yards, the practice being conducted as previously explained for distances under 300 yards, except that two markers will be employed for each point, who in passing to their designated positions will preserve such an interval that the pace of one will not be influenced by that of the other, and that the distance signalled shall be the mean of their independent measurements. The instructor will be careful, in selecting markers, to assign to the same point one man whose measurement of distance is generally too large, and another whose measurement is generally too small.

802. For distances between 300 and 600 yards, the errors should not exceed $\frac{1}{4}$ of the true distance, and the most apt men should be able to confine their errors to less than $\frac{1}{8}$.

803. A similar system will be followed in the preliminary instruction, and in estimating by sight distances between 600 and 1,000 yards; squads of three or four men should be selected for the markers, some standing and some kneeling or sitting and lying down.

804. At these distances the average soldier should be able to estimate to within less than $\frac{1}{4}$, and the more proficient to at least within $\frac{1}{8}$ of the true distance.

805. Officers should avail themselves of all the opportunities for estimating distances afforded their men, and should privately make and record for their

own instruction and guidance their estimates of different distances before hearing the opinions of the soldier.

Officers should also extend their own practice up to 1,500 yards, using for markers at these long distances squads of six or eight men, sometimes on foot and sometimes mounted.

After estimating these long distances, they should be accurately measured with a range finder, or a chain, or tape.

806. After the majority of the men have become fairly proficient in the exercises as previously described, it will be found advantageous to divide the company into two squads, and to march the squads in opposite directions, each preceded by several men to pace the distance traversed, until in succession different points previously selected by the instructors are occupied. At each halt the squads will be faced about and estimates made, according to the methods already explained, in each squad by each man, of the distance separating the squads. When all have estimated, the opposite squad will be signalled, and as soon as a reply is received they will be informed (as in paragraph 796) of the distance of the first squad from the place where they separated, as it was measured by the designated men. The second squad will then signal their distance from this same point; the total of these distances will be the distance between the squads. The same method will be followed for all of the points occupied by the squads.

807. In this method of conducting the practice, as well as in that previously described, care should be taken that the men do not count, or too closely ob-

serve, the number of steps required for the markers to reach their designated positions. The men also should not be permitted to communicate to each other their estimates, but each one required to make their determinations uninfluenced by the opinions of others.

808. While instructions in estimating distances should be independently conducted, yet it can be combined with target firing with great advantage; this is especially true on extensive ranges where bodies of men are generally conducting target practice simultaneously at several distances.

809. These other firing squads can then be considered as markers at known distances (since the relation between different points on the range is generally accurately known), and the men, while waiting their turn to fire, called up in succession and their instruction conducted as closely upon the model indicated in paragraph 789 as is practicable. When the absence of other firing parties renders this method impossible, advantage should be taken of any time when the markers at the target may be visible, or of the presence at different known points on the range of other soldiers who may be coming to, or returning from practice. Whenever practicable, painted figures of men standing or kneeling, cut from boards and of life size, should also be placed near the targets, and the attention of the men, in the intervals between their firing, frequently called to these figures, they being required to state such particulars in regard to them as they are able to discern at that distance.

810. For instruction in estimating distances by sight, a lieutenant or non-commissioned officer, accompanied

by several markers, may be sent to the vicinity of the range a short interval before the time designated for target practice. The lieutenant will then examine the record book of each of his markers and notice how many steps the man would take in measuring each 100 yards of the ground he desires him to traverse. He will then designate to each man the number of steps and the direction he wishes him to take, making a memorandum of the resulting distance of each marker. After the marker has taken the number of steps directed, he will face the instructor and take such a position as may have been designated.

811. The company, on its way to the target ground, will halt when it reaches the lieutenant or non-commissioned officer who preceded it, and the instruction of each man in estimating the distance of the different markers then conducted according to the general plan previously explained.

812. As each man in succession concludes his estimate, and his attention has been called to such errors as he may have committed, he will continue to the target ground and report to the officer on the range conducting the target practice of his company.

813. In all cases when estimating distances by sight, the circumstances of the ground, the conditions of the atmosphere, and the nature of the background materially influence the accuracy of the determinations; therefore these elements should always be noted, and their effect understood and considered.

814. In "Rifle Firing," Colonel Laidley states the following general rules as the result of careful and extended observations: First, when the light shines directly on objects, when they are light colored, or when

they are seen against a light background, their details are more clearly visible, and they consequently appear nearer than they really are. If the observer's back be turned toward the sun, the observation made in winter when the air is dry and clear, or else just before or after a rain, if the ground be level and of a uniform tint, or if it rise toward the object, the distance will appear less than it really is.

815. Second, under the reverse conditions the distance will appear greater, and if the eye follow the line of a canal or rectilinear road, and more especially if the road be bordered by walls or trees. The tendency, in looking from an elevation down to a lower level, is to estimate short of the true distance, and in looking upwards to a height it is just the reverse. On a wide plain of uniform color, such as water, snow, corn fields, meadows, etc., if the eye be arrested by no intermediate points, the estimate will be generally too short. This is also the case in judging distances over earthworks.

816. As a very simple aid to estimating distances, a silhouette in card-board of a standing or kneeling man can be used. The silhouettes should be 1.36 inches and 0.84 inches high respectively, with sufficient paper (left white) attached to their bases to allow of their being held between the thumb and first finger.

817. In estimating the distance of a group of men, the silhouettes should be held by a marker in the direction of the group whose distance is to be determined, while the soldier moves backward, keeping his eye upon the silhouettes and the group, and stopping when the figures and the men exhibit the same appearance and seem to form part of one and the same

group. The soldier then advances toward the marker, counting the number of steps that separates his eye from the marker's hand, and computing (from the known length of his step as determined by the measuring distance drill) the corresponding number of yards, or as the distance of the marker from the observer will not be great, it can be determined easily and with greater accuracy by direct measurement with a chain or tape. The number of yards between the observer and marker multiplied by 50 will give the required distance in yards of the group of men.

818. If found more convenient the silhouettes can be made of the same size as the illustrations (Figs. 1 and 2, Plate XVIII.) of the targets for individual skirmish firing; if used of this size the multiplier 50 should be replaced by 32.9, or the results will be given with sufficient accuracy, for the method followed, by using the multiplier $33\frac{1}{2}$, which will enable the soldier to simply multiply his measured distance from the marker by 100 and then divide the result by 3.

819. In clear weather this method can be advantageously employed for determining distances up to about 1,000 yards, using, if practicable, a field-glass when comparing the silhouettes and a group at the longer distances.

820. In all cases the image should be lighted as much as possible in the same manner as the men observed. If, for example, these latter were in shadow and the silhouettes brightly lighted, it would be necessary to cut off the sun's rays with the hand or cap.

821. The size of the silhouettes may be tested by observing men at some known distance—as 200 or 300 yards—the silhouettes (of the size mentioned in para-

graph 816) being for these distances 4 yards and 6 yards respectively from the soldier. Any errors discovered in the height of the figures should be corrected.

822. This method will generally be more accurate if used to estimate the distance of a group rather than that of a single soldier, for a possible error due to a single man being either under or over the average height, would be more likely to be neutralized when observations were made on several men at once.

CHAPTER III.

ESTIMATING DISTANCES BY SOUND.

823. This method, as generally followed by the soldier, will only possess value when the distance of more remote objects is but approximately desired, and even then considerable experience is required to obtain good results. It is based upon the fact that the velocity of sound in air of a temperature of 70° is about 1,130 feet per second. When used by the officer in connection with a stop or split-second watch, considerable accuracy may be attained.

824. As a preliminary to its employment the soldier should be taught to count up to 10 with such a cadence that the interval between each unit will correspond to the time required for sound to travel 200 yards. For this purpose a pendulum should be formed of a bullet and a string of adjustable length, and so arranged that it will make 113 single oscillations in one minute. The soldier should count (in sets of ten) the vibrations, and then count with the same cadence

without looking at the pendulum ; any tendency to count too fast or too slow should be noticed and corrected by the instructor.

825. When the cadence has been thoroughly learnt, the instructor will send three or four markers, armed, and provided with blank cartridges, to some designated point, whose distance has previously been determined ; or, if more convenient, the markers may pace and afterward signal the distance as in paragraph 796. At a signal from the instructor the markers will fire a volley and the soldier count as just prescribed during the time elapsing between seeing the flash or smoke of the discharge, and hearing the report.

826. This practice should be varied in the manner which will readily suggest itself to the instructor, according to the general method prescribed for estimating distances by sight.

827. When the men have learned to make these estimates by sound, with nearly the same relative accuracy for different remote distances as when estimating by sight, the markers should be placed behind some shelter, as in woods, shelter trenches, etc., etc., which partly conceal them from view, and at the signal from the instructor open fire, as if they were skirmishers, with blank cartridges, firing slowly and not more than two cartridges apiece. As before, the soldier will count and determine the distance, being careful not to confound the different shots. For long distances the firing should be by volley.

828. Estimating distances by sound cannot be advantageously followed if the men firing are so much concealed that the smoke is not quickly visible after the discharge. It affords, however, the best method

of obtaining the distance of an enemy at night when his position is often only marked by the flash from his rifles.

829. As in this exercise the proper cadence is easily lost it should be occasionally verified by means of the pendulum.

830. In this, as in the other methods of estimating distances, advantage should be taken whenever possible of the presence of the different arms of the service in the same garrison. The markers, especially for the longer distances, should at different times be composed of cavalry, infantry, and light artillery, both halted, deployed for action, and moving at their different gaits, so that the soldier may become familiar with the appearance of different troops at different distances, and thoroughly accustomed to determining their relative position.

PART VIII.

REVOLVER FIRING.

CHAPTER I.

DISMOUNTED PRACTICE.

831. ALL cavalry troops and all other soldiers armed with the revolver should be instructed in its use; the practice for the cavalry should also be conducted mounted.

832. Owing to the unsteady support that the hand gives to the weapon the methods of aiming previously prescribed for the rifle and carbine cannot be advantageously followed; this is especially true of the practice mounted, where the motion of the horse and the very limited time available for the delivery of the fire permit neither the steadiness nor deliberation so requisite for success with the other arms.

833. The best results will then be obtained by following the method of snap shooting; for which the pistol should be held raised and then quickly projected at the mark and fired without pause or any effort to align it upon the object, the action being somewhat similar to that employed in throwing a missile from the hand and from the same raised position of the arm.

834. The instruction will be commenced with the revolver not loaded, the men being taught the motions

and the methods of delivering the blow in different directions.

835. For this purpose, the men being formed in single rank with an interval of one pace between files, the instructor commands,

1. *Raise*, 2. PISTOL,

when the pistol will be drawn from the holster and brought to the position prescribed in the Cavalry Drill Regulations.

836. The pistols being in the position of *raise pistol* the instructor commands,

1. *Squad*, 2. READY,

at which the pistol will be cocked with the thumb of the right hand; this motion is greatly facilitated by giving the pistol a short quick jerk forward and downward, the weight of the barrel seconding the action of the thumb. The position of *raise pistol* is then resumed.

837. Separate commands for aiming and firing will not be given, but the fire delivered to the front at the single command,

FIRE,

when the soldier, looking with both eyes intently at the mark and not even glancing at the sights or the pistol, will lower the pistol smartly to the front, in the direction of the object, and fire without pause or any effort to align the sight upon the mark. The mark should be a black disk about the size of a target paster on the barrack wall, at the height of the soldier's head and about ten feet distant.

838. The instructor will pay particular attention to the manner in which the soldier holds the pistol; the

clasp of the thumb and second and third fingers should be firm, the first finger being on the trigger and the little finger underneath the end of the handle. If the clasp is too high up on the handle the muzzle will be elevated ; if too low, the muzzle will be depressed. The clasp should not be so tight as to communicate tremor to the pistol, yet sufficiently firm to sustain, when firing with ball cartridges, the force of the recoil. After the discharge the position of *raise pistol* will be resumed.

839. These motions will at first be executed rather slowly, the instructor correcting the positions if necessary, and the motions quickened as the soldier acquires the habit of levelling or projecting instinctively the pistol in the same manner that the forefinger would be pointed at an object.

840. Fire will be delivered to the right and front by the commands,

1. *Ready*, 2. **RIGHT OBLIQUE**, 3. **FIRE**.

At the first command the pistol is cocked as before, at the second the head and eyes are turned toward the right 45 degrees, and at the last command the pistol is levelled and fired in the direction in which the eyes are looking. The position of *raise pistol* is then resumed.

841. In a similar manner the men will be instructed in firing to the left and front, to the right, to the left, and to the rear, substituting the commands **LEFT OBLIQUE**, **TO THE RIGHT**, **TO THE LEFT**, **TO THE RIGHT AND REAR**, **TO THE LEFT AND REAR**, and **TO THE REAR** for the second command above. When firing to the left the pistol hand will be about opposite the left shoul-

der ; when firing to the right and rear or left and rear the shoulders will be turned 45 degrees to the right or left respectively ; in firing to the rear they will also be turned 45 degrees to the right ; for the other firings they will be kept nearly square to the front, such slight variations being made, however, as may be necessary to obtain an easy and natural position.

842. As soon as the soldier is familiar with the methods of delivering a single shot he will be practised in the methods of firing several shots ; generally the number corresponding to the contents of the chamber. For this practice the command *Commence FIRING* will be substituted for that of FIRE as given in the preceding paragraphs. In executing these commands the pistol will be brought back after each shot to the position of *raise pistol*, when it will be cocked and the following shot delivered.

843. Instruction will then be given with blank cartridges, the troop being formed in echelon to the front at distances and intervals of 5 or 10 yards, so that each man can fire in all directions without injury to the other men.

844. For instruction in firing ball cartridges ranks will be broken, and the practice conducted with but one man at a time. The target will be that used for gallery practice at 50 feet (paragraph 148), and will for the first firing be 5 yards, to be afterward increased to 10 yards from the soldier. The cartridge employed will contain 10 or 12 grains of powder and a round ball. Practice will be held in firing in the different directions previously prescribed.

845. When the soldier exhibits proficiency in the preceding practice he will be advanced to firing with

the regular service cartridge at the A target used for rifle and carbine firing on the range. For cavalry troops the course of instruction, which for all, both officers and enlisted men, will be conducted each year, will consist of the preliminary and regular or record practice ; the former comprising not less than 5 nor more than 20 shots at the distances 10, 25, 50 and 75 yards, firing to the front, the position being standing, off-hand, without rest or support of any nature for the pistol or pistol arm, and the latter two scores, of five shots each, at each of the distances 25, 50 and 75 yards. These firings may be preceded or supplemented by additional practice at the same or different distances in the discretion of the troop commander, but the distinctions and rules governing these classes of practice as prescribed in paragraphs 204 to 208, and paragraph 216 will always be observed.

CHAPTER II.

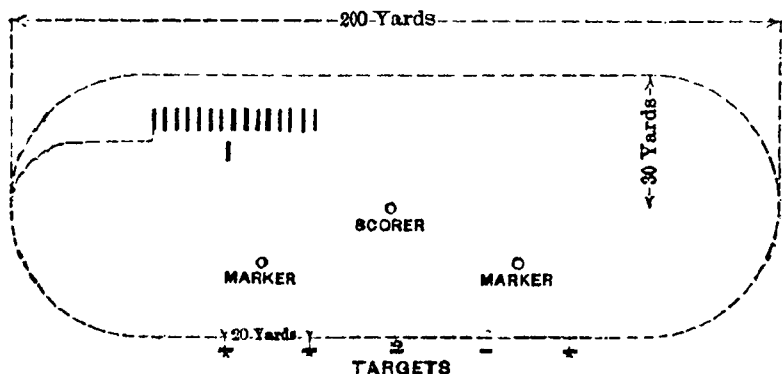
MOUNTED PRACTICE.

846. THE different steps of the instruction, when mounted, will be conducted according to the general plan outlined for the dismounted practice, the exercises for the recruit commencing as soon as he has become fairly proficient in the school of the trooper mounted.

847. At a convenient part of the drill ground several A targets on temporary frames, or the silhouette target D, should be placed ; they should be 30 or 40 yards apart and faced in the same direction. The troop should be divided into as many squads as there are

targets, and each squad formed opposite its target and about 20 yards from it. By the commands and means prescribed in the SCHOOL OF THE TROOPER MOUNTED, the squads will be manoeuvred in front of their respective targets, circling to the right and left by squad and by trooper, the soldier (chambers being empty) practising at first by command and then at will the motions of firing in different directions. The gaits employed will be first the walk and then the gallop. This practice will be continued, with the trooper using blank cartridges.

848. When the soldier becomes accustomed to handling the pistol mounted and the horses used to the firing, the practice will be continued upon the target range where the track, and targets 5 yards distant (the silhouette target "D" only being used), will be arranged, as nearly as the ground permits, as illustrated by the accompanying diagram :



849. Before firing ball cartridges the squad will be manoeuvred in column of troopers on the track in

front of the targets, each trooper as he passes each target going through the motions of firing, with empty chambers. A canter and afterward a full gallop will be taken in this exercise.

850. In subsequent exercises when passing the targets the distance will be increased to twenty yards between troopers, provided the horses can be properly controlled, and the gait increased to a gallop; the trot being taken upon entering the opposite long side until closed, the head of the closed column halting so as to allow the troopers to resume the increased gait at the proper moment. Blank cartridges will then be fired and this exercise continued until each trooper can fire five cartridges with deliberation and coolness in the time occupied in passing by the targets.

851. For firing with ball cartridges the troop will be formed as illustrated in the diagram. At the proper command each trooper will move out from the right at a walk, take up the trot and gallop and at the latter gait move along the line of targets delivering one shot at each. He will then resume the trot and take his place on the left of the troop. The succeeding trooper will follow at such an interval, depending upon the tractability of the horses, as the troop commander deems most advisable, but preferably not moving out until the hits made by the preceding trooper have been determined and the shot holes pasted.

852. After the troopers become skilled in the use of the revolver, firing to the right, the practice will be conducted firing to the left; then placing the targets obliquely to the track the firing will be to the right front, to the left front, and to the right rear in the or-

der stated. In firing to the left the men move out by trooper from the left, and move around the track with the targets on the left hand. Each of these varieties of the practice will be preceded by the preliminary instruction specified in paragraph 849.

853. For practising firing directly to the front, four D targets will be arranged in line with intervals of five yards and the troop formed in front of the targets at a distance of 100 yards. At the proper command each trooper from the right in succession will advance on the targets, open fire when 80 yards from them and, firing five shots between that point and the targets, pass between them and return to the troop.

Before firing ball cartridges, this practice will be held with chambers empty, the trooper going through the motions of firing; a canter, and for the final practices a full gallop being maintained during the firing.

854. For further practice in firing to the front the targets will be arranged with intervals of between 5 and 10 yards, in the discretion of the troop commander, and the troopers, with corresponding intervals, advanced by fours upon them, firing as for the charge of the single trooper, passing between the targets and returning to the left of the troop.

The number of targets will then be increased to correspond to the number of troopers in a platoon and the entire platoon advanced in a manner similar to that for the fours, firing and returning to the troop as above directed.

The preliminary and later instruction in these two practices will be conducted as prescribed in the preceding paragraph.

855. When the troopers, individually and collec-

tively, have been carefully instructed in all the preceding practices, they will each be repeated with ball cartridges, and a careful record for final report made of the result, each hit being scored one. This record or regular mounted pistol practice then consists of the following course: with the targets arranged as in paragraph 848, one run (five shots) for each trooper firing in each of the prescribed directions, viz., to the right, left, right front, left front and right rear, or 25 shots in all.

With the targets arranged as in paragraph 853, one run (five shots) for each trooper firing as there prescribed.

The course of individual mounted firing thus comprises thirty shots; it will be followed by each officer and enlisted man.

With the targets arranged as in paragraph 854, two runs (ten shots per man) for each set of fours, and two runs (ten shots per man) by platoons.

The course of collective firing thus comprises twenty shots and the entire regular mounted course is therefore completed in 50 shots, which with the 30 shots for the regular dismounted course makes a grand total of 80 shots for the entire course.

856. Instruction in revolver firing will be carried on during the regular practice season, care being exercised that during the first month it is held on those days not favorable for carbine firing. During the second month, when the carbine practice will generally be only the collective firing of the troop, the revolver practice will be more energetically pushed and the course completed by the close of the season.

At the close of the first month and of the first and

second weeks of the second month troop commanders will report, by letter, to the Inspector of Small Arms Practice of the Department the number of times practice has been held and the progress made in the prescribed course; and at the close of the season will report on the proper form (Form 30-f) the score of each officer and man in the dismounted practice, the number of hits made by him in each of the required individual mounted practices, and the number of hits in the collective practice, when firing by fours and by platoons. The per cent. of possible score for the troop for all this firing will also be given. A summary of this final report, giving the per cent. of each troop in revolver firing will accompany the annual report (Form 30) of the Department.

APPENDIX A.

RELOADING CARTRIDGES.

857. Ordnance notes numbers 114, 231, and 322 describe fully the methods of reloading cartridges and the precautions to be observed; every officer should familiarize himself with their requirements and suggestions.

858. The order of operations as there given and fully explained is as follows:

Extract the primer; wash and wipe dry the shell; inspect the shell; lubricate the body slightly, keeping the interior head and the pocket free from grease; resize; scrape out the burr from the mouth (this will not always be necessary); prime; load and crimp; these various operations can be best performed by detailing the requisite number of men and giving each one charge of a particular operation. If the extraction of the primer and the cleaning of the case are done as soon as the shell is fired, as recommended in paragraph 860, a detail of four men will be needed.

859. Reloaded shells will generally sustain many more rounds if always fired from the same gun; to obtain this advantage in the company practice would require the soldier to collect his empty shells after firing, and, both when being reloaded and afterward, to keep them separate from others until fired. The resulting additional trouble and time required for reloading will be more than requited by the increased life of the shell and the freedom from the annoyance on the target ground caused by a ruptured cartridge case.

860. It is desirable that the residuum on the interior of the shell and around the seat of the primer be early removed after firing; the primer

extractor might then be advantageously taken to the firing ground and the primers removed from the empty cartridge cases as soon as each man has completed his scores. The soldier should then throw the shells into a pail of water, remove them and wipe them dry with a clean rag. Or if it is not considered practicable to carry a bucket of water to the target ground, a bottle of water and the brush-wiper issued with the sets of reloading tools will answer. If this plan is followed, the old primers should be extracted and the shell cleaned as soon as the soldier returns to the barracks.

861. Before resizing, the exterior of the shell should be slightly lubricated; but if the remaining operations of reloading are to be immediately performed, particular care must be exercised that the interior of the case is kept clean and dry. If the soldier at the resizing-die will frequently wipe his hands on an oiled rag, and then, taking several cases at a time, roll them between his hands, they will be sufficiently lubricated. Any shells that cannot be readily driven fully into the resizing-die will be rejected.

862. In priming, the primer must be pushed well down in the pocket, so that it will not project above the level of the head; if the primer pocket is clean and the tool properly set this can always be done.

863. It is very necessary that the charging should always be done in the same manner, or uniform results need not be expected from the reloaded cartridge; the charger should simply be dipped into a bowl of loose powder, the powder not being shaken or settled down, but smoothed off with a lead-pencil; the fall of the powder through the funnel will settle it uniformly in the shell.

864. As the initial velocity of the cartridge is greatly affected by the moisture absorbed by the powder (see paragraph 702), especial care should be taken that the powder is kept in a dry place and one uniformly heated.

865. Reloaded shells often rupture a short distance in front of the heads, about at the point where the flow of the metal from the cylindrical to the conical surface of the interior commences to form the solid head. This change of condition probably causes a line of weakness, or possibly it is caused by the peculiar shape of the feed-punch (as used in the manufacture of the cartridge case), necessitated at this point to sustain

the blow of the bumper and to give space for the flow of the metal forming the head.

866. It is presumed that the action which may cause the rupture of the shell is as follows. At the moment of discharge the metal near the bullet end of the shell being thin, readily expands and presses tightly against the surface of the chamber, and if no lubricant is present the walls of the chamber will grip and hold it closely. The portion of the case near the head, being thicker, does not expand so readily, and is therefore not fully sustained, certainly not so closely grasped as the other end, and therefore if the breech-block does not press against the head of the case, the shell, instead of moving bodily against the block, will be subjected to a strain of tension, the front end being held tightly and the rear free to move; rupture may then follow at the weakest point.

867. This condition will be aggravated if any lubricant is present on the case near the head, but none at the bullet end; it can be avoided to a great extent by lubricating slightly, before firing, the whole body of the shell, or at least that portion near the bullet; it will be sufficient for this purpose to rub over the shell a slightly oiled rag before inserting it into the chamber.

868. The cartridge used for gallery practice consists of the surface shell charged with from 4 to 7 grains of powder, depending upon the strength of the powder and the distance over which firing is held, and a round ball which is between .454 and .459 inch in diameter. The ball weighs about 140 grains, and is lubricated over its entire surface with a thin even layer of Japan wax.

869. The endurance of the service shells when used only for gallery practice is between 200 and 300 rounds; they should be occasionally washed in warm water, and if they become expanded so as to fit tightly the chamber of the gun they should be resized; this, however, will not often be required. The lead recovered from firing can be re-melted and cast three or four times.

870. The charge of powder being so small, slight variations in its amount considerably affect the accuracy of the fire; great care should therefore be exercised in loading; the ball, well lubricated, should be placed in immediate contact with the powder and two or three drops of

melted lubricant should be dropped from an oil-dropper on the ball after it is in the shell; it will cool at once and retain the ball firmly in position. If this latter precaution is not taken, the soldier before loading his rifle should lightly tap the bullet with a lead-pencil or small wooden drift, as it is essential that there be no air-space between the powder and the bullet.

871. The details of the arrangements and assignments of the men for facilitating the different operations of reloading, will readily suggest themselves to the company commander; every effort should always be taken that while the work is carefully done, it yet is as little of a burden as possible upon the company.

APPENDIX B.

ALLOWANCE OF AMMUNITION.

872. The preceding courses of preliminary and regular firing contemplate the following expenditures of rifle and carbine ball cartridges.

Individual Known Distance Firing.

Range.	RECRUIT COURSE.		SECOND SEASON'S COURSE.		SUBSEQUENT COURSES.	
	Preliminary practice.	Regular practice.	Preliminary practice.	Regular practice.	Preliminary practice.	Regular practice.
100	15	..	..	40	..	20
200	15	40	5	40	5	20
300	15	40	10	40	10	20
500	15	40	10	40	10	20
600	15	40	10	40	10	20
800 .....	..	..	10	40	10	20
Total { For sharpshooters For lower classes.	..	..	45	200	45	100
	75	160	35	160	35	80

Individual Skirmish Firing.

RECRUIT COURSE.		SECOND SEASON'S COURSE.	
Preliminary practice.		Preliminary practice.	Regular practice.
1 Run at each silhouette in succession on target B....	30 shots	1 Run at each target D, E and F=30 shots.	4 Runs at group target, 2 shots per halt = 80 shots.
1 Run at each target, D, E, and F.....	30 shots	1 Run at group, two shots per halt=20 shots.	
1 Run at group target.....	10 shots	SUBSEQUENT COURSES.	
1 Run at group target, two shots per halt.....	20 shots	Preliminary practice.	Regular practice.
Total	90 shots	1 Run at group target, 2 shots per halt = 20 shots.	2 Runs at group target = 40 shots.

Collective Firing.

COMPANY SKIRMISH.		COMPANY VOLLEY.	
Preliminary practice.	Regular practice.	Preliminary practice.	Regular practice.
1 Company run, total 20 shots per man.	4 Company runs, total 80 shots per man.	1 Series of volleys, total 15 shots per man.	4 Series of volleys, total 60 shots per man.

878. If it is presumed that one-fifth of the company pursue the recruit course, one-fifth that prescribed for the second season and three-fifths that for subsequent seasons, and that one-half of those two latter classes

fire scores at 800 yards for attempted qualification as sharpshooter, the expenditures can be summarized as follows :

Summary of Ammunition Expenditures.

	Individual practice.	Collective practice.	Proportional multiplier.	Total expenditure.
Recruit	325	...	2	650
Second season:				
Sharpshooters....	295	...	1	295
Marksmen.....	245	...	1	245
90 per cent. firing	...	175	90% of 2	315
Subsequent season:				
Sharpshooters ...	165	...	3	495
Marksmen.....	135	...	3	405
90 per cent. firing	...	175	90% of 6	945

Average expenditure per officer and man for the entire company per year..... 335

874. The regular or record course of revolver practice requires the expenditure of 60 ball cartridges per officer and man for individual firing, and 20 cartridges more for collective firing. The amount of preliminary and additional practice being left almost entirely in the discretion of the troop commander is only limited by the ammunition available which as stated in paragraph 878 should give about 115 shots for this instruction which will be principally expended in mounted practice.

875. To provide for these expenditures, ammunition to the value of \$4.00 per officer or enlisted man will be allowed for those firing with the rifle, to the amount of \$3.50 for those firing with the carbine and to the amount of \$1.00 for each enlisted man of the Cavalry arm and for each officer and sergeant of any arm of the service for practice with the revolver.

These allowances, and the number of shots which must be fired during the course of instruction prescribed in the body of this work, are based upon the amounts appropriated by Congress for the manufacture of ammunition and cannot therefore be exceeded.

876. The values of small-arm ammunition and of the component parts

thereof are determined by the Chief of Ordnance and will be published from time to time in general orders for the government of the Army.

877. On the basis of the price lists now in force, the value of the different original and re-loaded cartridges is as follows :

For Rifle—One original cartridge.....	1.85 cent.
Re-loaded cartridge—one bullet, 500 grains.....	0.545 cent.
One primer.....	0.06 “
One charge of powder, 70 grains.....	0.18 “
Total.....	0.785 cent.
For Carbine—One original cartridge.....	1.7 cent.
Re-loaded cartridge, one bullet, 405 grains.....	0.457 cent.
One primer.....	0.06 “
One charge of powder, 55 grains.....	0.141 “
Total.....	0.658 cent.
For Revolver—One original cartridge.....	1.00 cent.
Re-loaded cartridge, one bullet, 230 grains.....	0.25 cent.
One primer.....	0.06 “
One charge of powder, 28 grains.....	0.094 “
Total.....	0.404 cent.

878. The average expenditure of ammunition throughout the Army is at least four re-loaded cartridges for each original, and this proportion must be maintained in order that the course as prescribed may be conducted. With the prices of the preceding paragraph it will permit the firing of 80 original and 321 re-loaded rifle cartridges or of 80 original and 325 re-loaded carbine cartridges and of 35 original and 160 re-loaded revolver cartridges per officer and enlisted man. As the course of preliminary and regular practice requires the firing of 835 shots with rifle or carbine (paragraph 873), about 70 shots can be fired by each soldier in additional practice.

879. The total money value of the year's allowance of ammunition for any company will be determined by multiplying the allowance for a single soldier, as given in paragraph 875, by the total number of officers and men (including those attached for practice) who have fired at any time during the practice season.

880. In addition to the above allowance for target practice, each regimental staff and band, each battery of artillery and company of infantry will be allowed, during each target year, for gallery practice

6,000 round balls,
15,000 cartridge primers,
15 pounds of powder,
15 pounds of lubricant,

and each troop of cavalry

8,000 round balls,
20,000 cartridge primers,
20 pounds of powder,
20 pounds of lubricant.

This allowance of ammunition for gallery practice is based upon the supposition that the round balls will always be recovered and recast for future use. The proper tools for this purpose are provided and issued to companies. The round balls are however not supplied when it is practicable to recover and recast, for gallery practice, the rifle and carbine bullets that have been fired in practice on the range.

881. For the further instruction of the soldier—more especially the recruit—and for firing at drills, funerals, etc., such an amount of rifle and carbine blank cartridges as the company commander deems requisite, not exceeding 2,000 rounds for each company of infantry or battery of artillery, and 4,000 rounds for each troop of cavalry, will also be allowed.

In addition, each troop of cavalry will be allowed 5,000 rounds of blank revolver ammunition.

882. As regards the allowance of ammunition for practice firing, enlisted Indian scouts are on the same footing as regular troops.

883. In selecting men from companies to compete in the department competitions, no additional ammunition can be allowed, and cartridges for any special firing that it may be desired to conduct, or that may be

used in the training of the men after their selection, must be obtained from the regular allowance of the company.

884. Except bull's-eye firing no matches or competitions in addition to those required in paragraphs 593 to 605, inclusive, will be permitted in connection with the annual competitions. For these competitions the allowance of ammunition will be as follows: To each officer or enlisted man participating in the preliminary practice—240 cartridges; to each participating in the competition—240 cartridges; to each participating in the revolver match—40 ball and 20 blank cartridges.

885. The company allowance of ammunition can, in practice, be greatly increased if the bullets are recovered and recast after firing. The service bullet for reloading the rifle cartridge is valued at 0.545 cent. If a remoulded bullet is used, the cost of a single reloaded cartridge will then be reduced to one-fourth of a cent, and the number of shots that each man can fire increased to at least 1,500. This will, however, necessitate the expenditure of but very few original cartridges, or of those reloaded with the bullets issued to companies.

886. Although the moulds for recasting the service bullet have not yet been supplied to troops, their use will be found so necessary if a very great amount of ammunition is desired that each company should provide itself with what is required for this purpose.

887. As in many cases the ambition of the soldier to excel in rifle and carbine firing may be so great that he will desire, for his improvement, cartridges in excess of the amount that can be provided him from the company allowance, and as it is above all desirable that this ambition be fostered and encouraged, both officers and men will be permitted to purchase from the United States either original cartridges or such component parts of such cartridges as they desire. Ammunition so obtained must only be employed in target firing.

APPENDIX C.

TABLES OF FIRE.

TABLE I.—Table of Fire of Springfield Rifle, with Service Cartridge : 70 grains Powder, 500-grain Bullet.

Range.	Angle of elevation.			Time of flight.	Remaining velocity.	Energy.	Penetration in white pine.	Mean deviation.	Drift.
Yards.	°	'	"	Secs.	Feet.	Ft.-lbs.	Inches.	Inches.	Inches.
100 ..	0	17	53	0.25	1,172.0	1,525.4	19.1	1.3	1.29
200 ...	0	31	18	0.50	1,059.2	1,245.9	16.5	2.7	3.0
300 ...	0	44	58	0.75	968.0	1,079.6	14.1	4.2	5.1
400 ...	1	0	32	1.00	932.0	964.6	12.1	5.8	7.8
500 ...	1	17	18	1.25	886.0	871.7	10.6	7.6	11.5
600 ...	1	34	30	1.60	844.5	792.0	9.7	9.5	16.1
700 ...	1	52	36	1.97	806.9	723.0	9.0	11.6	21.9
800 ...	2	12	2	2.37	772.4	662.5	8.3	13.8	28.35
900 ...	2	34	36	2.81	740.7	609.3	7.6	17.0	35.7
1,000 ...	2	58	10	3.29	711.6	562.3	7.0	21.4	43.2

TABLE II.—*Table of Fire of Springfield Carbine, with Service Cartridge : 55 grains Powder, 405-grain Bullet.*

Range.	Angle of elevation.	Time of flight.	Remaining velocity.	Energy.	Penetration in white pine.	Mean deviation.	Drift.
Yards.	° ' "	Secs.	Feet.	Ft.-lbs.	Inches.	Inches.	Inches.
100 ...	0 22 32	0.28	1,018	930	14.5	1.7	1.14
200 ...	0 31 23	0.58	913	749	11.4	4.2	1.33
300 ...	0 43 15	0.91	827	616	9.3	6.5	2.8
400 ...	0 58 30	1.26	757	515	8.0	9.0	5.0
500 ...	1 18 36	1.62	697	437	7.25	11.7	9.55
600 ...	1 40 12	2.00	646	376	6.7	15.5	15.75
700 ...	2 3 23	2.40	602	326	6.3	19.0	25.44
800 ...	2 27 22	2.80	564	286	5.9	23.5	37.30
900 ...	2 52 52	3.21	530	253	5.5	26.0	40.0
1,000 ...	3 19 53	3.64	500	225	5.0	30.0	62.0

TABLE III.—*Ordinates of Trajectories above Line of Sight.*
RIFLE.

Range.	100 yards.	150 yards.	200 yards.	250 yards.	300 yards.	350 yards.	400 yards.	450 yards.	500 yards.	550 yards.	600 yards.	650 yards.	700 yards.	750 yards.	800 yards.	850 yards.	900 yards.	950 yards.	1,000 yards.
Yds.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.
100	0																		
200	1.1	0.8	0																
300	2.3	2.6	2.4	1.5	0														
400	3.7	4.6	5.1	4.9	4.1	2.4	0												
500	5.1	6.7	7.9	8.5	8.4	7.5	5.7	3.2	0										
600	6.6	9.5	10.9	12.2	13.0	12.9	11.9	10.1	7.6	4.2	0								
700	8.1	11.3	14.1	16.1	17.6	18.4	18.3	17.1	15.4	12.8	9.4	5.2	0						
800	9.8	13.8	17.4	20.2	22.6	24.2	24.7	23.9	22.1	19.6	16.9	11.9	6.5	0					
900	11.6	16.5	21.0	24.9	28.2	30.8	32.3	33.2	33.5	32.7	31.2	28.9	25.5	21.1	15.5	8.6	0		
1,000	13.5	19.4	24.8	29.7	34.0	37.6	40.3	42.1	43.4	43.7	43.4	42.0	39.8	36.4	32.1	26.0	18.5	9.7	0

TABLE IV.—*Ordinates of Trajectories above Line of Sight.*

CARBINE.

Range.	100 yards.	200 yards.	300 yards.	400 yards.	500 yards.	600 yards.	700 yards.	800 yards.	900 yards.	1,000 yards.
Yards.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.
100	0									
200	1.5	0								
300	3.2	3.3	0							
400	5.2	7.4	5.8	0						
500	7.3	11.6	12.3	8.7	0					
600	9.7	16.2	19.3	17.9	11.3	0				
700	12.1	21.0	26.4	27.3	23.5	14.5	0			
800	14.4	25.9	34.0	37.5	36.3	29.7	17.9	0		
900	17.3	31.5	42.1	48.3	49.8	45.9	36.8	21.7	0	
1,000	20.0	37.1	50.5	59.7	63.8	62.7	56.3	43.9	25.4	0

TABLE V.—*Dangerous Space for Rifle Fired Standing.*

Range.	AGAINST INFANTRY KNEEL- ING.			AGAINST INFANTRY STAND- ING.			AGAINST CAVALRY.		
	In front.	In rear.	Total con- tinuous.	In front.	In rear.	Total con- tinuous.	In front.	In rear.	Total con- tinuous.
Yards.	Yards.	Yards.	Yards.	Yards.	Yards.	Yards.	Yards.	Yards.	Yards.
100...	All.	39.0	139.0	All.	72.5	172.5	All.	122.0	222.0
200...	All.	43.0	243.0	All.	70.0	270.0	All.	100.0	300.0
300...	41.0	35.0	76.0	86.0	45.0	131.0	All.	74.0	374.0
400...	30.0	26.0	56.0	49.0	42.5	91.5	87.0	63.0	150.0
500...	24.0	21.0	45.0	38.0	34.0	72.0	62.0	50.0	112.0
600...	19.0	17.0	36.0	30.0	26.5	56.5	45.5	40.5	86.0
700...	15.0	14.0	29.0	23.0	22.5	45.5	35.0	32.0	67.0
800...	13.0	11.5	24.5	19.5	17.0	36.5	29.0	25.0	54.0
900...	10.0	9.0	19.0	15.5	14.5	30.0	22.0	21.0	43.0
1,000...	8.5	8.0	16.5	12.5	10.0	22.5	19.0	17.0	36.0
Range corresponding to maximum continuous dangerous space. ...	215 yards.			255 yards.			310 yards.		
Dangerous space beyond object	41 "			60 "			72 "		

TABLE VI.—*Dangerous Space for Rifle Fired Lying Down.*

Range.	AGAINST INFANTRY KNEEL- ING.			AGAINST INFANTRY STAND- ING.			AGAINST CAVALRY.		
	In front.	In rear.	Total con- tinuous.	In front.	In rear.	Total con- tinuous.	In front.	In rear.	Total con- tinuous.
	Yards. All. All. All.	Yards. 100 0 70 0 46 0 30 0 24 0 18 5 15 5 12 5 9 5 8 5	Yards. 200 0 270 0 346 0 64 0 51 0 39 5 32 0 26 5 20 0 17 5	Yards. All. All. All. 66 0 44 5 34 0 25 5 21 0 16 5 13 0	Yards. 183 0 106 0 68 0 49 0 39 0 30 5 25 0 18 5 15 5 11 0	Yards. 183 0 206 0 368 0 114 0 83 5 64 5 50 5 39 5 32 0 24 0	Yards. All. All. All. 101 0 66 0 47 0 37 0 31 0 24 0 20 0	Yards. 264 0 147 0 92 0 69 0 53 0 42 0 34 0 27 5 23 0 18 0	Yards. 364 0 347 0 392 0 170 0 118 0 89 0 71 0 58 5 47 0 38 0
Range corresponding to maximum continuous dangerous space.....	312 yards.			347 yards.			370 yards.		
Dangerous space beyond object	44 "			53 "			70 "		

TABLE VII.—*Dangerous Space for Carbine Fired Standing.*

Range.	AGAINST INFANTRY STAND- ING.			AGAINST CAVALRY.		
	In front.	In rear.	Total con- tinuous.	In front.	In rear.	Total con- tinuous.
Yards.	Yards.	Yards.	Yards.	Yards.	Yards.	Yards.
100.....	All.	58	158	All.	90	190
200.....	All.	54	254	All.	82	282
300.....	65	41	106	All.	59	359
400.....	39	32	71	60	44	104
500.....	27	24	51	42	32	74
600.....	22	19	41	32	27	59
700.....	18	16	34	25	23	48
800.....	13	14	27	20	20	40
900.....	11	11	22	17	16	33
1,000.....	10	10	20	15	14	29

TABLE VIII.—*Defiladement for Rifle Fired Lying Down.*

Distance.	HEIGHT OF OBSTACLE.							
	.5 yard.	1.0 yard.	1.5 yard.	2.0 yards.	2.5 yards.	3.0 yards.	4.0 yards.	5.0 yards.
Yards.	Yds.	Yds.	Yds.	Yds.	Yds.	Yds.	Yds.	Yds.
200.....	55.0	109	162	213	265	320	416	512
250.....	43.0	85	126	166	205	247	326	405
300.....	36.5	72	105	138	173	207	270	335
350.....	35.0	60	88	116	144	173	226	280
400.....	26.0	51	75	100	125	150	199	247
450.....	22.5	44	66	88	111	131	175	219
500.....	20.0	39	59	79	98	116	157	194
550.....	17.5	35	53	70	87	104	140	173
600.....	15.5	31	47	62	78	93	124	155
650.....	14.0	28	42	56	69	83	111	138
700.....	12.5	25	38	50	62	75	100	124
750.....	11.0	22	33	44	55	66	88	110
800.....	10.0	20	29	39	49	59	78	97
850.....	9.0	18	26	35	44	53	70	87
900.....	8.0	16	24	32	40	48	64	80
950.....	7.5	15	22	30	38	45	60	75
1,000.....	7.0	14	21	28	35	42	56	70

APPENDIX D.

BLANKS.

SOLDIER'S TARGET RECORD.

SHORT RANGE PRACTICE.

Date, June 6 1885

Range, 200 yds

Arm. Rifle

Ammunition, 70-503

Weather, Warm-Damp

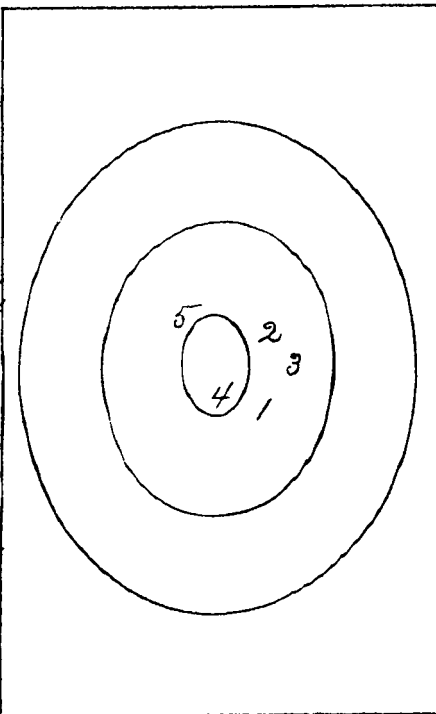
Light, Bright

Elevation.

$$\frac{1}{225}, \frac{2}{235}$$

Wind, 2 o'clock - Light

Wind Gauge.

$$\frac{1}{24} R, \frac{4}{0}$$


NUMBER OF SHOTS AND SCORE.

[illegible]

(FORM No. 30—C.)

Report of the Progress in Target Firing of Co. _____, Regi- ment of _____ for the month of _____ 18____.

(See Part IV, Chapter IV, Blunt's Firing Regulations for Small Arms.)

	Sighting Drills.	Position and Aiming Drills	Gallery Practice.	Estimating Distances.	Range Practice.					Individual Skirmish Practice.
					200 Yds.	300 Yds.	500 Yds.	600 Yds.	800 Yds.	
Number of drills during the month										
Average number practicing										
Number receiving no instruction ...										
Number who have completed regu- lar course at										

Number following the recruit course

Number following the second season's course

Number following the course for subsequent seasons

Individual Classification and Figure of Merit of the Company at the End of the Month.

..... Sharpshooters	x	200
..... Marksmen	x	100
..... First-class men	x	60
..... Second-class men	x	30
..... Third class men	x	10
..... Present not firing	x	0

Individual Figure of Merit

Number of practices in company skirmish firing

Number of practices in volley firing

Number of practices in firing by file

Practice season

Fort

18____

I certify that to the best of my knowledge and belief the course of regular practice, both individual and collective, has been conducted according to the requirements of the Firing Regulations for Small Arms; that the methods of marking and scoring, there prescribed, have been fully complied with, and that such additional precautions as seemed necessary to secure an honest record and correct report, based only on the results actually obtained, have also been taken, and I am therefore fully assured that this report is entirely correct.

1st Lieut.

2d Lieut.

Commanding Company.

1ST ENDORSEMENT.*Fort*..........*18*.....

Respectfully forwarded to the Inspector of Small Arm Practice Department of

I have examined the methods of conducting practice and of marking and scoring followed in this company, and believe this report to be correct.

REPORT

OF THE

TARGET FIRING

OF

Co......*Reg't of*.....*for the Month of*.....*188*.....

(FORM NO.

Report of the Target Firing of the

(See Part IV, Chapter IV, Blunt's)

Company.	Number Firing, and average per cent of the Scores in Individual Practice.										Individual			
	200 Yards.		300 Yards.		400 Yards.		500 Yards.		800 Yards.		As Skirmishers.		Sharpshooters.	Marksmen.
	Number Firing.	Av. per cent of scores.	Number Firing.	Av. per cent of scores.	Number Firing.	Av. per cent of scores.	Number Firing.	Av. per cent of scores.	Number Firing.	Av. per cent of scores.	Number Firing.	Av. per cent of scores.		
Staff and Band.														
A														
B														
C														
D														
E														
F														
G														
H														
I														
K														
L														
M														
Regiment														

This report is a correct compilation

Approved:

....., Comd'g Reg't.

DEPARTMENT OF ----- 1885.

DEPARTMENT COMPETITION,
600 YDS. 1ST DAY.

DEPARTMENT OF ----- 1885.

Name, -----

Co. and Reg't, -----

No.

No.

DEPARTMENT COM-

PETITION,

600 YARDS.

1ST DAY.

August ----- Order ----- Target -----

1	2	3	4	5	6	7	8	9	10	TOTAL	1	2	3	4	5	6	7	8	9	10	TOTAL

Score Keeper's, {
Signature, -----*To be detached by Score
Keeper and returned to Com-
petitor.*

200 YARDS.

ONE BULL'S-EYE.

Scorer.

300 YARDS.

BULL'S-EYE TARGET.

*Entitles the Bearer to one Shot at
Bull's-Eye Target.*

SCORER'S RECORD IN SKIRMISH FIRING AT COMPETITIONS.

DEPARTMENT OF 18.....

SKIRMISH FIRING, DAY.

Name,

Co. and Reg't,

August, Order, Target,

Halts	1	2	3	4	5	6	7	8	9	10	Total
Shots Fired											

Firing before "Commence Firing," Not firing at halt.....

Firing after "Cease Firing," Exceeding limit.....

SCORE KEEPER'S }
SIGNATURE. }

This record will be kept by the scorer following each competitor in skirmish firing as required by paragraph 608.

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